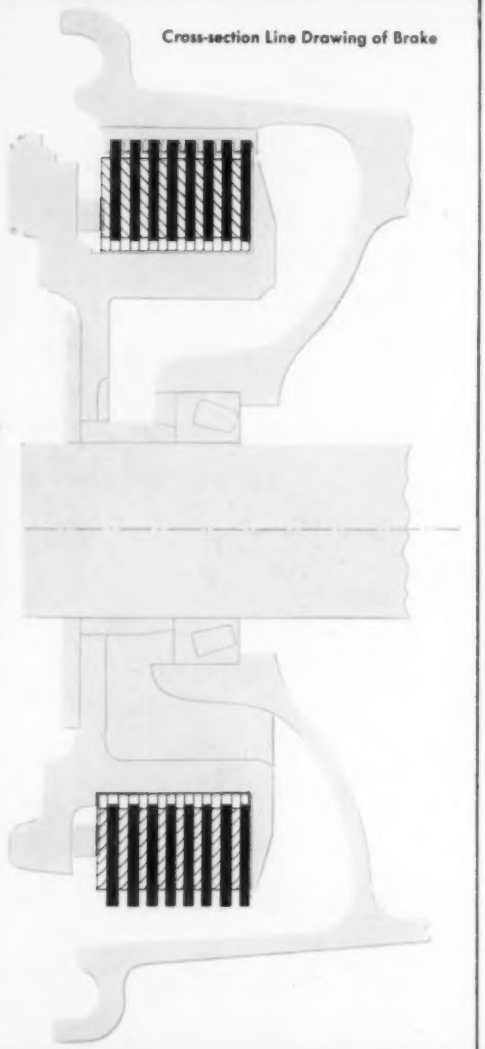
AVIATION WEEK

A McGRAW-HILL PUBLICATION

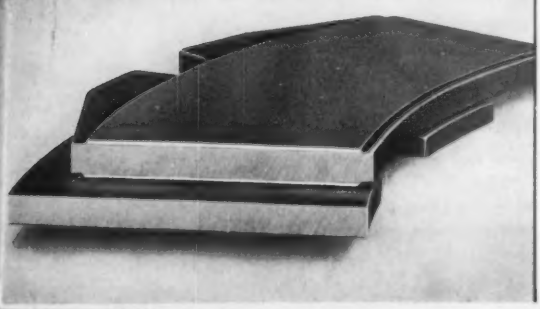
AUG. 15, 1955

50 CENTS

Cross-section Line Drawing of Brake



Typical Disc Cross Section Through Friction Pair



Goodyear proudly announces:

The Tri-metallic Brake

The brake that gives up to 50% increase in absorption of Kinetic Energy per pound of brake

RECOGNIZING the fact that the weight and speed of today's airplanes were fast approaching the limits and capacities of existing aircraft brakes, Goodyear concentrated its skills and resources to pioneer the answer.

The result is The Tri-Metallic Brake: a brake which utilizes a new friction material and new combinations of metals, making a "heat sink" of the lining, its mating member, and the brake structure—thereby greatly increasing the kinetic energy absorption per pound of brake.

The advantages of The Tri-Metallic Brake are spectacular:

(1) weight-savings and space-savings that result from the greatly increased efficiency of this new brake design, (2) a new metallic, non-insulating lining which will operate at temperatures up to 70% higher than other designs of this type, (3) low displacement and high torque, giving further economy in weight and space, (4) simplicity of design with greatly reduced number of parts.

For full details you are invited to write: Goodyear, Aviation Products Division, Akron 16, Ohio or Los Angeles 54, California.

GOODYEAR AVIATION PRODUCTS

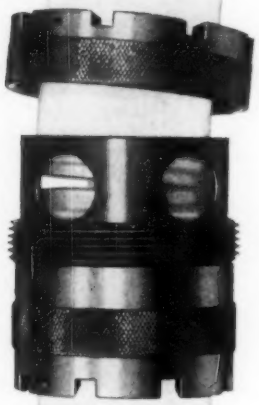
FACILITIES + ABILITIES = EXTRA *plus* IN PERFORMANCE

Are You Interested In WEIGHT REDUCTION?

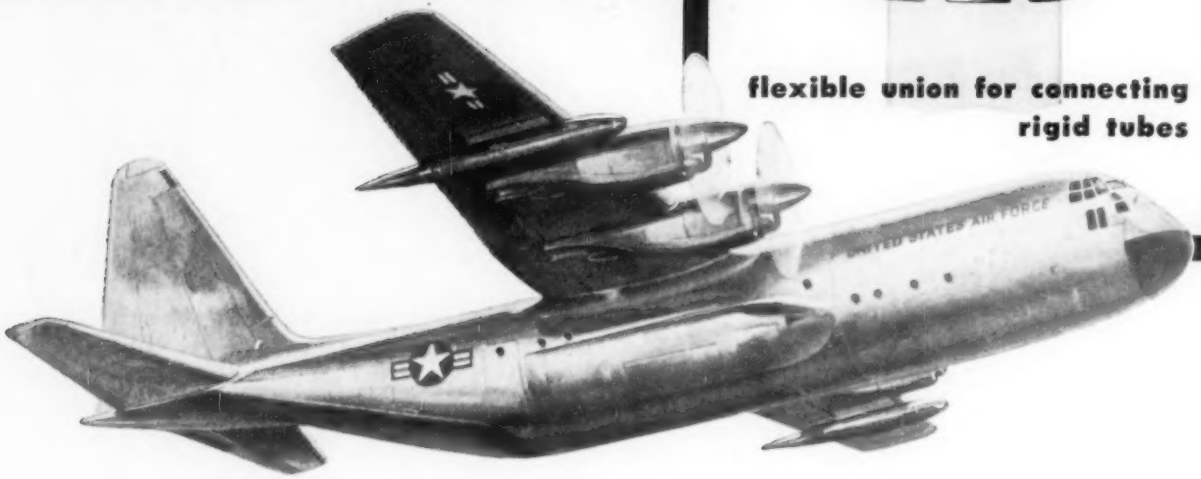
WIGGINS COUPLINGS SAVE 88 POUNDS ON LOCKHEED C-130

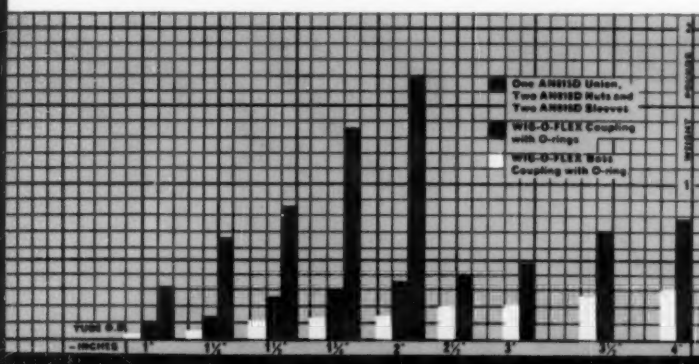
America's first turbo-prop transport—the Lockheed C-130—is 88 pounds lighter because WIG-O-FLEX Couplings replaced standard AN connections and cut hose. WIG-O-FLEX Couplings weigh 1/5 as much as the standard AN connections they can replace. (See Weight Chart for exact comparisons.)

WIG-O-FLEX COUPLING



flexible union for connecting rigid tubes





WEIGHT COMPARISON CHART

WIG-O-FLEX COUPLING & AN STANDARD FLARED TUBE CONNECTION

PROVED SUPERIOR FOR FUEL, OIL, AIR

- Withstands more than 1000 psi burst pressure.
- Accommodates 4° tube flexure.
- Installs locally. 80% lighter.
- Temperature range —65°F to +250°F.

SIZES: 1", 1¼", 1½", 1¾", 2", 2½", 3", 3½", 4"

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BALANCED DESIGN
ROD ENDS!

3 SIZES; high capacity roller bearing rod ends. 2 SIZES; ball bearing rod ends. WRITE FOR ENGINEERING BULLETIN.

Working closely with aircraft designers and engineers on top priority problems of advanced aircraft design is the highly-regarded stock-in-trade of Fafnir Bearing Engineers. Typical product of this close association is the new Fafnir "balanced-design" Rod End Series . . . the first line of rod ends to be developed with a specific relationship between shank strength, bolt strength and bearing capacity. The Fafnir Bearing Company, New Britain, Conn.

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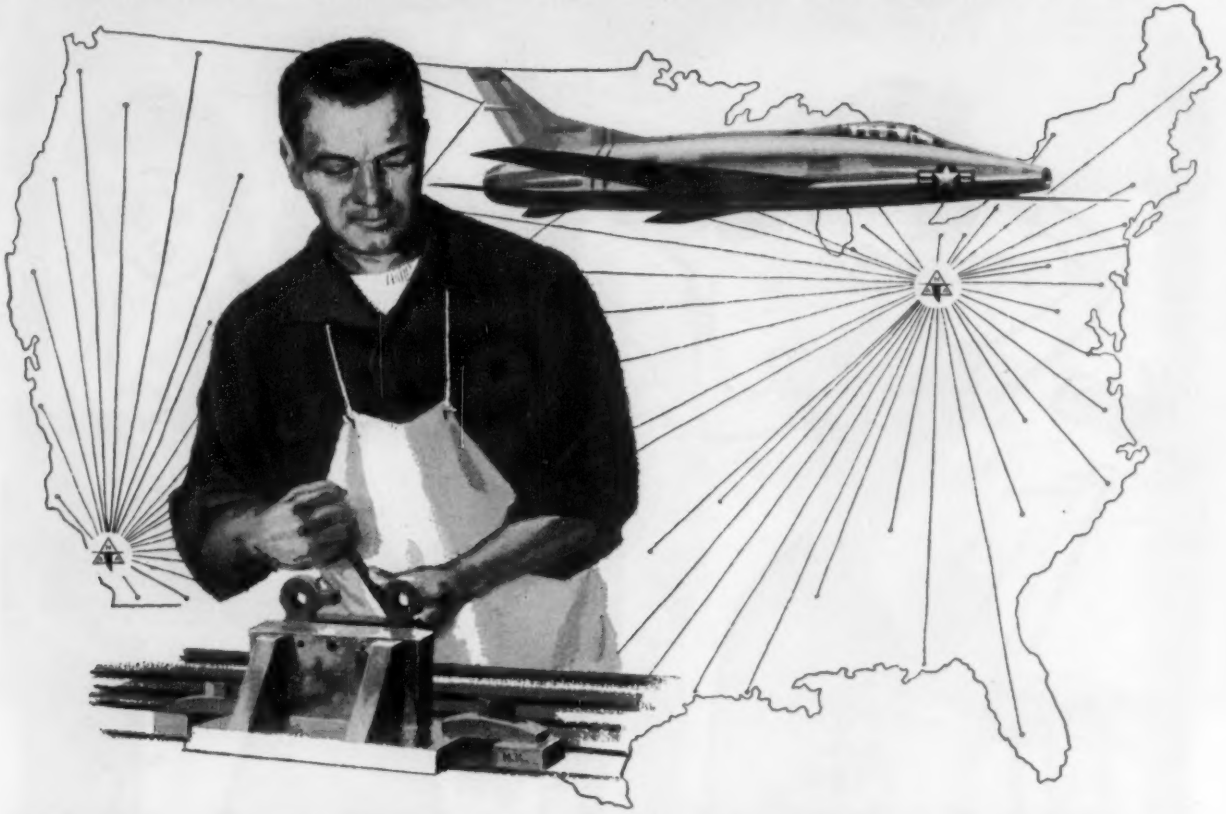
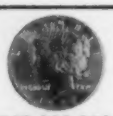


SMALL BUSINESS IS BIG BUSINESS WITH US

55% OF NORTH AMERICAN'S TOTAL OUTSIDE SPENDING GOES TO SMALL BUSINESS

Building our jet air defense . . . planes like the new F-100 SUPER SABRE, FURY JET and F-86 SABRE JET . . . is a complex job in which small business plays a vital role. Last year for example, small businesses . . . firms with less than 500 employees . . . received more than 55% of the $252 million that North American spent for outside materiel, supplies and labor.



$252,000,000. was total spent by North American for materiel, supplies and outside labor.

55% of the total spent went to small suppliers . . . companies with less than 500 employees.

North American Relies on Small, Aggressive Suppliers. A company like North American operates best when its many suppliers are all "on the ball." Because small businesses are constantly increasing their efficiency, North American and the aircraft industry look to them as important additional sources . . . but before North American can add a new firm to its list of sub-contractors, the company must first survey the prospective sub-contractor and determine if the firm has the necessary machinery, personnel, production know-how and financial ability to deliver the goods.

North American Experts Help Small Business Become More Efficient. Sometimes the supplier must revamp a large part of his entire production set-up. North American experts help with this work, because as the prime contractor, North American is responsible for on-time delivery and quality of the finished product. A special group from North American's Manufacturing and Quality Control Departments travels thousands of miles a month to check, coach and assist sub-contractors.

The fact that small suppliers received 55% of all North American purchases . . . proves that small business is assisting in delivery of high quality goods and services, at competitive prices . . . on time.

Yes, small business is big business with North American Aviation.

ENGINEERING AHEAD FOR A BETTER TOMORROW

NORTH AMERICAN AVIATION, INC.

AUGUST 15, 1955

AVIATION WEEK

VOL. 63 NO. 7

Editorial Offices

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WASHINGTON 4..1189 National Press Bldg.
Aviation Week is served by Press Association Inc., a subsidiary of Associated Press.

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57,706 copies of this issue printed

AVIATION WEEK • AUGUST 15, 1955 • Vol. 63, No. 7
Member ABP and ABC

Published weekly by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive Editorial, Advertising and Subscription Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Circulation Director.
Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.
Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.
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Icy Nerves

Getting in and out of a big city on a holiday weekend, of course, calls for icy nerves and a steady hand. Traffic on the George Washington Bridge, from New York City to New Jersey, soars from its daily average of 85,000 cars to as much as 134,000 and jams have developed on Route 17, the feeder line, as far as Monticello, New York, 84 miles from the bridge. C. McKim Norton, vice president of New York City's Regional Plan Association, predicts by 1970 it will take an overnight trip to reach the open countryside. Within 15 years, he said, the New York metropolitan area will be a continous tight packed section extending 40 miles north of Manhattan and 70 miles east and west

Excerpted from a Wall Street Journal story of June 21, 1955.

Buy the Freedom of the Air for YOURSELF!

Statistics prove that corporation aircraft are more than FIVE TIMES safer than automobiles, measured by accident fatalities per 100 million occupant-miles.

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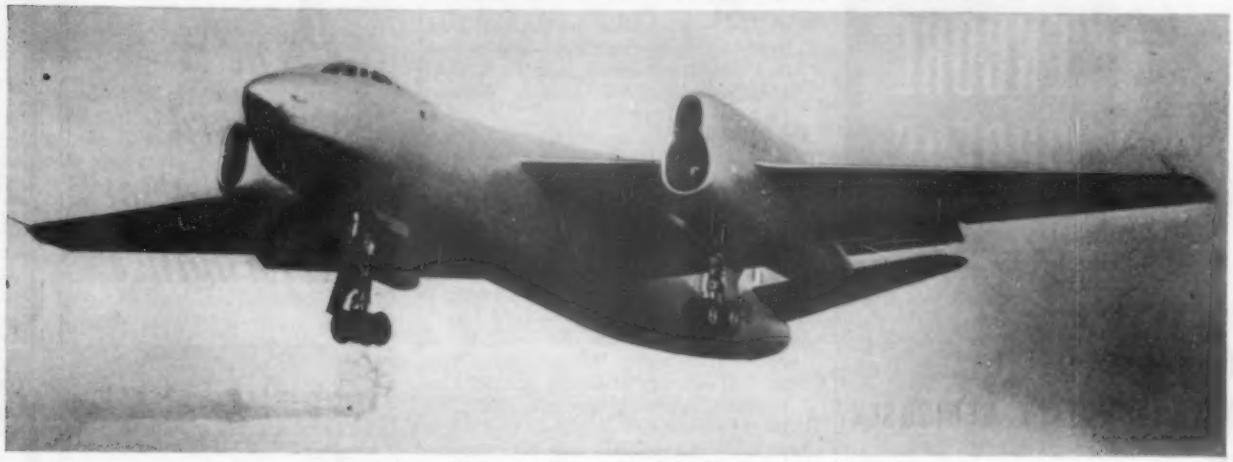
NEWS DIGEST



De Havilland Gyron Aloft in Testbed

Powerful Gyron turbojet engine has taken to the air in Short Sperrin SA. 4 flying testbed (AW Aug. 1, p. 9). Lower and bulging, port nacelle has been redesigned to take the new de Havilland engine. Lower starboard nacelle also will be reworked to take a second Gyron. Sperrin's regular powerplants are four Rolls-Royce Avons, installed in vertical pairs on each side of the British bomber's fuselage.

Quarles Appointed Air Force Secretary

Donald A. Quarles, 61 who has served for two years as Assistant Secretary of Defense for Research and Development, has been named Secretary of the Air Force by the President. He succeeds Harold Talbott who resigned as a result of a congressional airing of his business activities as a partner in the New York management firm, Mulligan & Co. Prospect is that Quarles appointment will be non-controversial.

Quarles was vice president of Bell Telephone Laboratories from 1948-52. He later became a vice president of Western Electric Co. and president of Sandia Corp.

Quarles last year headed a Defense Department team making a detailed study of the guided missile programs of the three services.

Domestic

New multi-million-dollar contract was awarded Convair by the Air Force for production of F-102A interceptors and TF-102 combat proficiency trainers. This is the third USAF order for the all-weather, supersonic F-102A and the second for TF-102s, two-place version of the delta-wing interceptor. The F-102A is being produced at Convair-San Diego for the Air Defense Command. Deliveries of production interceptors has started at Palmdale, Calif., where the company is building new facilities for F-102A field operations. Convair's Fort Worth Division will fabricate sections of the TF-102A and ship them to San Diego for final assembly.

Alfred S. Koch, 25-year veteran of the Civil Aeronautics Administration and predecessor agencies, will retire Sept. 30 as director of the Office of Aviation Safety. His successor has not been named. Koch plans to become a private aviation consultant.

American Airline's Convair 240 crashed near Fort Leonard Wood, Mo., Aug. 4 when an uncontrollable engine fire ate through the transport's right wing as it tried to make the military field for an emergency landing. All 30 persons aboard were killed. The following day at Chicago, a Northwest Airlines Stratocruiser crashed through a fence on its final landing approach at Midway Airport. There were no injuries.

Air collision between two C-119s at Echterdingen Field, near Stuttgart, Germany, last week killed all 67 aboard the planes. Air Force says one of the planes pulled abruptly into the path of the other when it developed engine trouble shortly after takeoff. The Flying Boxcars were part of a nine-plane flight on a training mission.

Wilcox Electric Co. expects to be producing air traffic control (radar) transponders by the end of this year under a new agreement that gives it exclusive manufacturing and sales rights for the unit developed by Melpar, division of Westinghouse Air Brake Co. The airborne transponder, which has undergone several thousand hours of service tests aboard Lake Central Airlines' DC-3s, is reported to meet carrier specifications prepared by Aeronautical Radio, Inc.

More than 200 Flying Boxcars will be modified by Fairchild Engine & Airplane Corp.'s Aircraft Division under an extension of the USAF C-119 modernization program now under way at the Hagerstown, Md., plant. The new contract increases to more than 500 the number of C-119s scheduled for modification by Fairchild.

Delta-C&S Air Lines ordered six more DC-7s from Douglas Aircraft Co., with deliveries scheduled to start in mid-1957. The new contract increased the number on order by Delta to 11. The carrier already is operating 10 DC-7s.

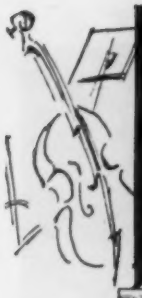
Financial

Fairchild Engine & Airplane Corp.'s net earnings for the first half of this year dropped to $2,108,000 from $2,288,000 for the comparable period of 1954. Sales totaled $78,911,000, compared with $70,844,000 a year ago.

Lear, Inc., reported record shipments of $29,023,044 for the first six months of this year, an increase of $1,750,000 over mid-1954. Backlog of orders June 30 totaled $46 million, a gain of $8 million. Earnings after taxes were $876,366.

International

Vickers Valiant set a new Singapore-Darwin speed record of 4 hr. 3 min. Aug. 8, bettering by 21 min. the previous mark set by a twin-jet English Electric Canberra over the 2,095-mile route. The Valiant is powered by four Rolls-Royce Avon jet engines.



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AVIATION CALENDAR

Aug. 22-23—Symposium on Electronics and Automatic Production, sponsored by Stanford Research Institute and the National Industrial Conference Board, Sheraton-Palace Hotel, San Francisco.

Aug. 22-24—American Rocket Society and Northwestern University, Gas Dynamics Symposium, Evanston, Ill.

Aug. 24-26—Western Electronic Show and Convention (WESCON), Civic Auditorium and Fairmont Hotel, San Francisco.

Aug. 24-26—International Ignition Conference, conducted by Scintilla Division of Bendix Aviation Corp., Sidney, N. Y.

Sept. 3-5—Twenty-ninth National Aircraft Show, Philadelphia International Airport.

Sept. 6-11—Society of British Aircraft Constructors, Aircraft Show and Flying Display, Farnborough, England.

Sept. 6-17—National Machine Tool Builders' Assn., Production Engineering Show and Machine Tool Show, Navy Pier and International Amphitheatre, Chicago.

Sept. 7-10—American Society of Photogrammetry, semi-annual Convention and Trade Show, Statler Hotel, Los Angeles.

Sept. 8—Airwork-Pratt & Whitney Aircraft Forum, Millville, N. J. Second forum will be held Sept. 16 in Miami.

Sept. 12-16—Instrument Society of America, Instrument-Automation Conference and Exhibit, Shrine Exposition Hall and Auditorium, Los Angeles.

Sept. 17—Institute of Radio Engineers, Symposium on Automation, Cedar Rapids, Iowa.

Sept. 17-18—Antique Airplane Assn., Convention and Fly-In, Ottumwa, Iowa.

Sept. 19-21—American Rocket Society, Western Fall Meeting, Los Angeles.

Sept. 21—Southwest Airmotive Engine Forum, sponsored by Pratt & Whitney and Bendix, Melrose Hotel, Dallas.

Sept. 21-22—American Helicopter Society, second West Coast Forum, Hollywood-Roosevelt Hotel, Hollywood, Calif.

Sept. 28-29—American Institute of Electrical Engineers and Institute of Radio Engineers, Park Sheraton Hotel, Detroit.

Sept. 29-30—Radio Technical Commission for Aeronautics, fall assembly, Hotel Statler, Washington, D. C.

Oct. 3-5—Eleventh National Electronics Conference, Hotel Sherman, Chicago.

Oct. 4-6—Eleventh annual Aircraft Spark Plug and Ignition Conference, sponsored by Champion Spark Plug Co., Secor Hotel, Toledo, Ohio.

Oct. 5-7—National Business Aircraft Assn., eighth annual Meeting and Forum, Sheraton-Cadillac Hotel, Detroit, Mich.

Oct. 5-7—1955 National Airports Conference, sponsored by American Association of Airport Executives and University of Oklahoma, Norman, Okla.

Oct. 5-9—World Plastics Fair and Trade Exposition, National Guard Armory, Los Angeles.

Oct. 11-15—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, Hotel Statler, Los Angeles.

Oct. 17-21—International Air Transport Assn., 11th annual general meeting, Waldorf-Astoria Hotel, New York.

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WHO'S WHERE

In the Front Office

Air Marshal Sir Richard Williams, Australia's director general of civil aviation, will retire at the end of this year. He will be succeeded by **Donald George Anderson,** present deputy director general.

Rear Adm. Lloyd Harrison (USN Ret.), vice president-procurement, McDonnell Aircraft Corp. Harrison was deputy and assistant chief of the Navy's Bureau of Aeronautics.

Lt. Gen. William E. Kepener (USAF Ret.) resigned as vice president of Bell Aircraft Corp. but will continue as advisor on military affairs. He became board chairman of Radiation, Inc., Aug. 1.

Francis R. O'Leary, executive vice president, Emhart Manufacturing Co., Hartford, Conn. Elected vice presidents: **Morton S. Cressy** and **J. Herbert Mosley.**

V. Charles Schorlemmer, administrative vice president, American Bosch Arma Corp., Garden City, N. Y. Also appointed: **Leslie E. Neville,** director of public relations and advertising.

George A. Seaver, vice president and general manager of Marman Products Co., Inc., Los Angeles, subsidiary of Aeroquip Corp.

Ralston H. Coffin, vice president-advertising and sales promotion, Radio Corporation of America.

Rear Adm. James Calcutt Hibbard (RCN ret.), board member of Fairey Aviation Company of Canada, Ltd. Hibbard was chief of personnel, Royal Canadian Navy.

Honors and Elections

Ralph S. Damon, president of Trans World Airlines, will be awarded the American Society of Mechanical Engineers' Spirit of St. Louis Medal "for meritorious service in aeronautics" Sept. 29 in St. Louis.

George R. Mellinger, chief of Engineering Flight Test facilities at North American Aviation, elected chairman of the Institute of the Aeronautical Sciences' Los Angeles Section.

Changes

Earle A. Ryder retired as consulting engineer for Pratt & Whitney Aircraft. Ryder was one of six men who designed and built the first Wasp radial air-cooled engine.

John B. Lawson, assistant general manager, Ford Motor Co.'s Aircraft Engine Division.

Philip C. Krause, chief of aerodynamics, Kellett Aircraft Corp.

Wallace Jay, general accounting manager, Convair-Fort Worth.

J. L. Thorne, sales manager, Fairey Aviation Co.

Robert M. Evans, passenger service manager, Pan American World Airways' Latin American Division. Other changes: **Capt. Frank M. Briggs,** division chief check pilot.

J. N. Wolfram, engineering manager, Parker Appliance Co.

R. P. McAlister, sales manager, Leach Relay Division of the Leach Corp.

(*Continued on page 69*)

INDUSTRY OBSERVER

► New complex communications system, which reportedly will enable USAF to talk with aircraft anywhere in the world, is being developed by Collins Radio Co. The development, which will employ new single side band techniques to increase available channels and improve intelligibility, is aimed at solving USAF's pressing communications problem.

► Britain has divided its rocket effort so that Rolls-Royce concentrates on developing larger types, de Havilland and Armstrong Siddeley on small, super performance types. British have concentrated on hydrogen peroxide and acid-JP4 as fuels for high performance rockets in combined power plants for fighter aircraft. Dassault 550 fighter has a mixed powerplant of a turbojet and rocket. The rocket is an acid-JP4 type.

► Look for a big sales pitch in Europe from Piasecki Helicopter Corp. in an attempt to crack the Sikorsky S-55 monopoly with a commercial version of the H-21. Transport version of the H-21 is now undergoing Civil Aeronautics Administration certification tests. Piasecki has employed Schreiner & Co., of The Hague, as its Dutch representative, and Walter G. Peck, formerly of Civil Aeronautics Board's foreign air carrier division, to work with Harry S. Pack, Piasecki's vice president for sales. Piasecki is planning to change its name. Suggested changes are United States Aircraft Corp., Philadelphia Helicopter Corp., and Transport Helicopter Corp.

► Orenda Engines Ltd., Toronto, is reportedly considering licensing the Allison Division of General Motors Corp. to manufacture the new Orenda PS13 in the U. S. The PS13 is in prototype production to power the new Canadian Avro CF-105 supersonic all-weather fighter being built for the Royal Canadian Air Force. Orenda is also negotiating its first export order for military jet engines with a South American country.

► KLM Royal Dutch Airlines has advised Bristol Aeroplane Co. it would consider the turboprop Britannia transport only as a freighter aircraft.

► Two new aircraft engines, the Gazelle with 1,260 hp., made by D. Napier & Son, and the Scarab, a 3,000-lb. thust solid fuel rocket motor made by the Royal Aircraft Establishment, were officially announced in Britain.

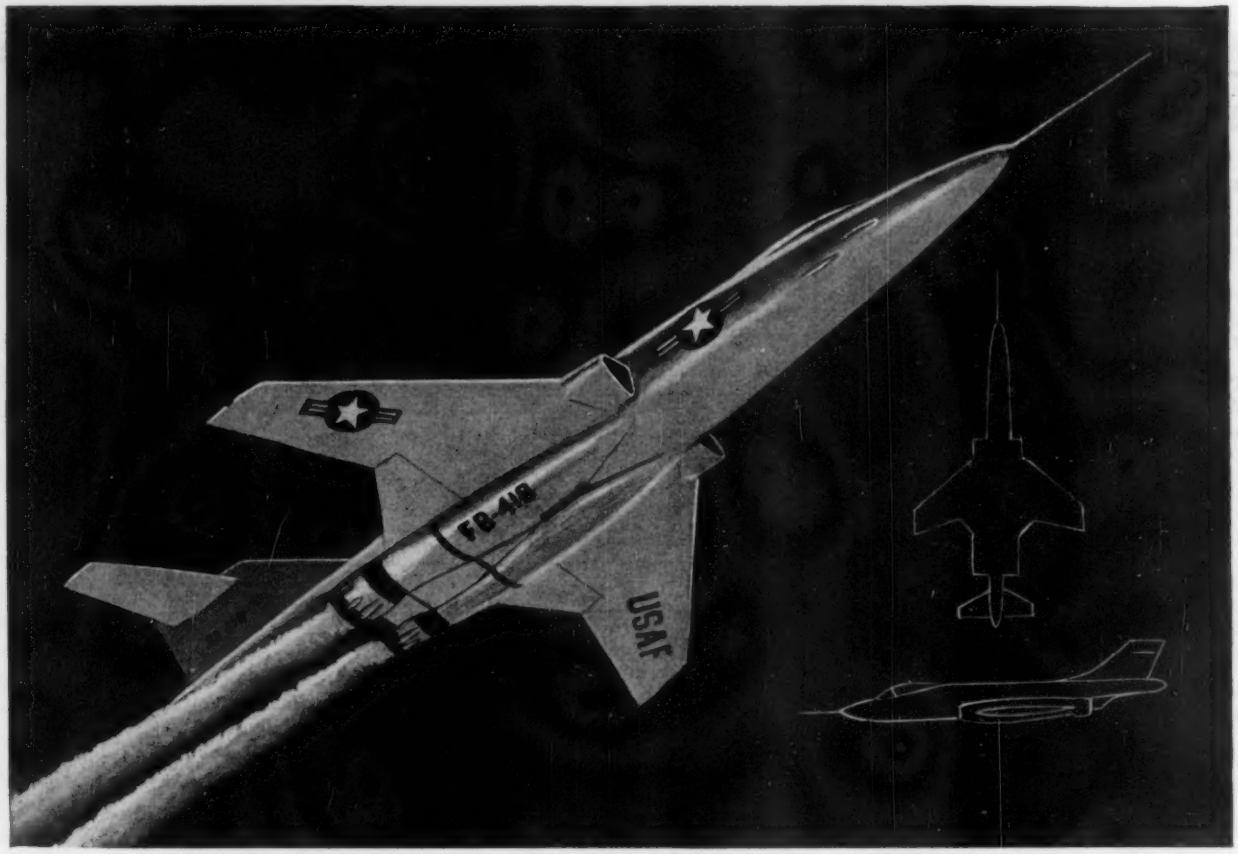
► Orenda 14 engine which powers the new Canadair Sabre VI is rated at 7,600 lb. thrust, up from the initial 5,800 lb. of the Orenda 2 engine. Engine weight has decreased from the 2,700 lb. of the Orenda 2 to about 2,400 lbs. for the newer models, despite the addition of an extra turbine stage. Need for strategic materials has decreased almost 40%.

► National Advisory Committee for Aeronautics flight test section at Langley Laboratory has been conducting interesting flight tests on helicopters' instrument flight characteristics at speeds below 40 mph. where the problem gets critical. Among the interesting phenomena discovered by this research is that a standard ILS glide path will produce on course readings in the cockpit instrument at low speeds while actual position of the helicopter is on collision course with terrain obstacles.

► Tests of the hull form of the Martin XP6M-1 SeaMaster conducted by National Advisory Committee for Aeronautics indicate that critical drag rise can be delayed up to and beyond Mach .9. Hull is characterized by a high length-to-beam ratio.

► Sikorsky's S-58 helicopter, with a cruising speed of 104 mph., will carry 12 persons or a net payload of about 4,000 lb. Top speed is about 132 mph. Normal range is about 270 nautical miles and equipped with auxiliary fuel tanks the aircraft has a ferry range of nearly 1,000 nautical miles. Cost per passenger-mile will be about 11 cents. Cost per ton-mile is expected to be about 70 cents.

► Two major airlines are closely following Navy-Douglas aircraft advanced cockpit instrumentation program, which displays information on two flat TV-type tubes (AW Jan. 17, p. 17) for possible use in future jet transports.



F-101A-VOODOO

U. S. A. F.'s New Fast, Long-range Fighter

Twin jets in the new F-101A Voodoo pack about *20,000 pounds of thrust.* They're Pratt & Whitney Aircraft J-57 Turbojet engines with afterburners. And they put the 67-foot-long Voodoo in the supersonic long-range fighter class.

McDonnell Aircraft Corporation of St. Louis is now producing the versatile Voodoo for service with the Strategic Air Command. Like other jets, the stubby-winged F-101A has many parts made of Inco Nickel and Inco Nickel Alloys.

That's because safe and satisfactory performance of supersonic aircraft demands that many parts have the unusual combinations of heat resistance, corrosion resistance, strength and ductility found in Inco Nickel and the Inco Nickel Alloys.

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Washington Roundup

Willis Interlude

Charles Willis, former assistant to Presidential Assistant Sherman Adams, who resigned to become assistant to the president of the Grace Line, figured briefly in a congressional hearing.

Assistant Attorney General in Charge of Anti-Trust Matters, Stanley Barnes, observed at a House Judiciary Committee session that he had received two telephone calls from Adams concerning Justice's anti-trust suit calling for a divestment of the joint ownership in Panagra by Pan American World Airways and W. R. Grace & Co.

He said the calls were relative to the President's duty to coordinate the activities of Civil Aeronautics Board and Justice Department on International Aviation. Barnes said no "pressure" was brought to bear. To a committee question, Barnes added that he had read in the newspapers that Willis had gone with Grace. He said that he is "happy" that he has had no discussions with Willis on the Panagra suit.

Government Information

A special House subcommittee has taken the first step in its investigation to determine whether information from government agencies "is sufficiently available—to the public, press, Congress, business groups, research specialists and other government agencies—or whether there is arbitrary and capricious action because of the lack of definite, consistent policies." All federal departments and agencies have been requested to answer by Sept. 15, 80 questions in a five-and-a-half page questionnaire.

The subcommittee is presently headed by Rep. John Moss (D.-Calif.).

The subcommittee is especially concerned with Defense Department information practices.

CAB Changes

Further personnel changes within Civil Aeronautics Board indicate efforts to consolidate the Republican position at the air regulatory agency.

Latest step is the appointment of Vernon Radcliffe, former CAB examiner and first administrative assistant to GOP member Harmar Denny, to the post of associate director of the Bureau of Air Operations. Radcliffe will rate at the same level and pay grade as Bureau Director Joseph H. Fitzgerald. Merwin F. Bagan was selected to replace Radcliffe in Denny's office.

Another move sees Joseph C. Watson succeed to the post of Chief, Foreign Air Division, a position he has held in an acting capacity since April. He replaces Walter D. Peck, former chief of the Foreign Air Division and since April a consultant in the Bureau of Air Operations. Peck resigned from the Board in mid-July.

CAA Reorganization

Continued reports of pending reorganization at the Civil Aeronautics Administration stems from a revival of the highly controversial and expensive ($104,000) survey report made by the Pittsburgh firm of Cresap, McCormack and Paget. The two-year old report, which has never been released, immediately became an unpopular project with Congress once it was learned that the Commerce Department had ordered it. Strenuous efforts have been made to kill the report but Commerce officials contend its still an open subject and may be re-activated at any time. The Cresap, McCormack and Paget report deals with the basic organization and methods of procedure at CAA.

Airmail Rate Increase

Congress ignored the request of the Postmaster General for an increase in the airmail postage rate from six to seven cents an ounce and will probably continue to ignore it.

Railroads will now insist that all mail moving by air must go at the airmail rate if either the House or Senate Post Office Committees do open hearings on the Postmaster General's proposals for postage increases.

Austrian Airline

North American Airlines is reported to have reached the contract signing stage in negotiations with Austria for operation of an Austrian international flag-carrier service.

Officials of the non-scheduled group have been shuttling between Vienna and U. S. continuously this summer to work out a deal which had its inceptions prior to the June signing of the Big Four-Austria peace treaty.

North American's negotiating team returns to the U. S. this week after another side-trip to England for further discussions with Bristol officials on the possible purchase of a quantity of the long range Bristol Britannias turboprop transport. North American hopes to make the Austrian deadline of Oct. 1 for inauguration of New York-Vienna service but would have to substitute its DC-6B equipment for the trans-Atlantic flight until Britannia deliveries can be made. North American plans to use DC-4 aircraft for the proposed intra-European service.

Wilson on Congressmen

Defense Secretary Charles Wilson recently was questioned on the possibility of the appointment of a member of Congress to the post of Secretary of the Air Force.

Wilson appeared surprised: "You mean put in a politician?"

Press: "How about it?"

Wilson's complete reply: "I don't underrate good politicians, but . . ."

Aircraft Marking

Hazards of identification of civil aircraft by high-speed military aircraft have led to a change in civil markings. Civil Aeronautics Board has decided to allow civil aircraft to be marked for side identification rather than top and bottom. Defense Department asked the CAB to make the change to speed up recognition of civil airplanes in restricted areas. CAB's special civil air regulation allows side markings not less than twelve inches high in place of markings on upper and lower wing surfaces.

—Washington staff

AVIATION WEEK VOL. 63, NO. 7
AUGUST 15, 1955

Democrats Win Air Issues in Congress

Acceleration of bomber, fighter production, feeder certification, airport aid, highlight first session.

By Katherine Johnsen

Washington, D. C.—This year's Democratic controlled Congress confidently challenged Administration's military and civil aviation programs—and won.

• **In military aviation,** congressional apprehension over Russian advances—disclosed in Moscow's May Day display—and congressional ire over footdragging by the Defense Department in disclosing the facts, forced an acceleration in the production of the Boeing B-52 bomber and two fighters—the McDonnell F-101 and the Lockheed F-104.

• **In civil aviation,** Congress forced two major programs on the Administration: permanent certification of local service air carriers and a long range airport program of $63 million federal aid for the next four years.

The Administration initially opposed outright both civil aviation measures. But two new Administration spokesmen—when it was clear that Congress was adamant on passing them—showed a compromising spirit. They were: Ross Rizley, who replaced Chan Gurney as chairman of the Civil Aeronautics Board, and Louis Rothschild who replaced Robert Murray as Under Secretary of Commerce for Transportation. When the measures were approved by Congress, largely on the recommendations of Rizley and Rothschild, the Administration showed enthusiastic willingness to implement them.

Moneywise, Congress for the most part gave aviation agencies what they asked for:

• **Air Force asked for $14.78 billion, received $14.73 billion.** Operations funds were trimmed. But the total request for aircraft and related procurement and for research and development were willingly granted. Congress was set to grant additional funds for an increase in fighter procurement, but they were not requested.

• **Naval aviation asked for $1.7 billion.** The estimate was shaved $4 million by Congress for detailed reasons—largely recalculation of transportation and fuel estimates. The fact that Naval aviation's budget request was $1 billion under its Fiscal 1955 budget caused most congressional concern. Navy Secretary Charles Thomas explained: the Navy had to cancel contracts on obsolete planes and won't be ready for large-scale orders of new types until next year. Then, he said, there will be a big increase in Navy's budget.

• **Civil Aeronautics Administration was granted the $160 million budget** it requested in a substantially revised form. CAA'S request for new navigation facilities was reduced $7 million. After considerable hearings and flurry, Congress tossed the question as to what the "common system" of navigation aids should be—Tacan or VOR/DME—back to CAA and related agencies. The congressional position was, though, that funds for new installations should be withheld until the "common system" is decided upon.

On the other hand, $9 million was added to CAA's $11 million request for federal aid for airports. The $20 million direct appropriation voted by the Congress is in addition to the $42.5 million in authority CAA has for federal aid airport contracts for Fiscal 1955 under legislation later enacted.

• **Civil Aeronautics Board** was given a record appropriation of more than $4.1 million for administration. Congress was eagerly behind Chairman Rizley's determined effort to hire more personnel, speed up case actions and cut back CAB's backlog of pending cases.

Congress cut $10.5 million from CAB's request of $63 million for subsidy payments to air carriers. But the $52.5 million approved was still more than the $48.9 million reluctantly granted for Fiscal 1956.

Subsidy funds have, and will continue to have, difficulty in getting congressional approval. This reluctance primarily is pressure on the CAB to cut back the demand. The general congressional opinion so far, though, has been that once a subsidy is determined by CAB, Congress is obligated to appropriate funds for it.

• **National Advisory Committee for Aeronautics'** request for $76.5 million was cut to $72.7 million—despite pleas by NACA's director, Dr. Hugh Dryden, that his agency's effort are the crux of tomorrow's air potential. The reason for the reduction in NACA's funds was that members of the House still look on the agency as a "mush-

Unfinished Business

Here is thumbnail sketch of some of the more important measures affecting aviation on which Congress acted upon or is scheduled to act upon:

RENEGOTIATION. Under the lead of former USAF Secretary Harold Talbott the law was extended to Dec. 31, 1956. In the meantime, the Joint Congressional Committee on Internal Revenue is making a study to decide whether it should be extended again.

PROTOTYPE TESTING AID. Legislation authorizing $12.5 million for testing of new types of transport aircraft, due to expire this year, was kept on the books. It's up to Commerce Department to work out a program and recommend funds to implement it to the Congress next year.

AIR TRANSPORT TAX. A measure exempting air travel to Canada, Mexico, Central America and the Caribbean area from the 10% transportation tax, passed by the House, will probably be passed quickly in the Senate next year. Other international travel is already exempted.

GOVERNMENT FEES. Senate Commerce Committee tossed the problem of increased fees for government services, to make agencies such as Civil Aeronautics Board and Civil Aeronautics Administration more nearly self-supporting, to the Government Operations Committee. A Commerce Committee resolution directs the Operations Committee to make a thorough investigation of the matter.

SUBSIDY RIGHTS. The proposal of CAB Chairman Ross Rizley and Under Secretary of Commerce for Transportation Louis Rothschild to make all air carriers eligible for subsidy—not just those certificated as mail carriers—was submitted too late for consideration in the last session.

RIGHT OF ENTRY. CAB's decision to ban the operations of North American Airlines touched off numerous pro and con reactions in the closing days of the session. Consideration of the "right of entry" is likely to be a big issue next year.

rooming bureaucracy" whose functions could as well be performed by the military within their ample research budgets. The Senate approved NACA's total $76.5 million request.

Aside from the Navy, all of the budgets voted for these aviation agencies were substantially higher than last year:

Air Force's budget was up $3.5 billion; CAA's up, $30 million; CAB's administrative budget was up $338,000.

Signs of Future

Secretary of Defense Charles Wilson remains a prime target of Democratic opposition. There were no major attacks on Wilson in this session of Congress, but they can be expected in the next. Indications of this are:

• **Observation of Rep. George Mahon (D.-Tex.),** Chairman of the House Appropriations Subcommittee on the Armed Services, that "the Secretary of Defense is a genius in the field of business and management, but if he has knocked any heads together in industry in an effort to get defense costs down to reasonable levels through better contracting I have not heard about it."

• **Speech by Rep. John McCormack (D.-Mass.),** majority leader, chiding Wilson for cancelling publication by the Defense Department of the contractors with the largest volume of business, and his subsequent publication, at congressional direction, of a list so dated that General Motors Corp. showed as having a "minus" volume of defense contracts.

• **Attacks on Defense Department mismanagement** this session by Sen. Stuart Symington (D.-Mo.), and other congressmen, have been buck shots at Wilson.

Many members of Congress, Democrats, in particular, regretted that it was Harold Talbott, who as Secretary of the Air Force had developed a relatively smooth working relationship with legislators, rather than Wilson who became entangled in the "conflict of interest code."

Both Rothschild and Rizley, as Commerce Department chief on aviation and as chairman of the CAB, have shown a desire to get on with Congress. Rothschild's predecessor, Robert Murray, was known for his aggravation of Republicans, as well as Democrats, in Congress. Rizley's predecessor, Chan Gurney, failed to capitalize on his especially advantageous position as a former Senator.

Rizley's comments on key civil aviation legislation have been submitted, purposefully or otherwise, without clearance of the Budget Bureau. The tactic is pleasing to members of Congress. Rizley, for example, supported with generalities a stepped-up airport program opposed by the Administration. He supported a limitation on the President's authority to veto decisions of the CAB without Administration approval.

Rothschild, by virtue of his position, has had to speak the Administration's position against such key legislation as $63 million a year in federal-aid for airports and permanent certification for local service airlines. But when both these measures were passed, Rothschild notified members of Congress that he had recommended against presidential veto.

Congressional antagonism has put Rothschild's chief, Secretary of Commerce Sinclair Weeks, in the background as far as civil aviation is concerned. The President's decision to overrule CAB and give Pan American World Airways the Seattle-Hawaii route, based on Weeks' advice, touched off an avalanche of Republican, as well as Democratic, protest. The President reversed, granted Northwest Airlines a renewal for competition on the route—and since then, Weeks has apparently had little influence on Administration in aviation.

Investigations Outlook

Before leaving Washington, Congress promised a heavy session of investigations on aviation next year. Spadework is now going on.

• **House Appropriations Subcommittee on the Armed Services** is aiming to find new ways to save money on defense. This includes cutting down profits to defense contractors and a re-evaluation of policies on determining the obsolescence of aircraft.

• **House Armed Services Investigating Subcommittee,** headed by Rep. Edward Hebert, is looking into profits on individual contracts of airframe manufacturers. The investigation was launched several months ago.

• **Senate Preparedness Subcommittee** has been dormant so far. A professional staff is following developments. But this subcommittee can be counted on to be active next year.

Senate Commerce Committee, after a series of hearings, decided to put off to next year consideration of revising 1938 Civil Aeronautics Act.

House Commerce Committee, despite pledges, didn't find time this session to consider omnibus aviation bills—introduced by Sen. Warren Magnuson (D.-Wash.), and Sen. John Bricker (R.-Ohio), chairman and ranking Republican on Senate Commerce Committee and by Rep. Percy Priest (D.-Tenn.) and Rep. Carl Hinshaw (R.-Calif.) of House Commerce Committee. House Commerce may consider the bills during the recess. But it is doubtful that anything concrete will develop from the consideration.

Senate Commerce took up legislation re-writing the 1938 CAA Act a year and a half ago at the request of the late Sen. Pat McCarran (D.-Nev.), a co-author of the 1938 Act. But there appears to be unanimous agreement that a re-write would be confusing and the best course from here on out is a course of specific amendments to the act.

Key to Red Plane Nicknames

The new nickname system for identifying Soviet planes uses a simple key: All fighter names start with the letter "F," bombers with the letter "B," cargo planes with the letter "C," and miscellaneous types with the letter "M." Piston engine plane nicknames have one syllable, jets have two syllables.

• **Piston engine fighters.** Fred (U.S. F-63A King Cobra, received by Russia during World War II), Fin (La-7), Fritz (La-9), Fang (La-11), and Frank (Yak-9).

• **Jet fighters.** Fargo (MiG-9), Fagot (formerly Falcon, MiG-15), Fantail (undisclosed type), Feather (Yak-17), Flora (Yak-23), Fresco (MiG-17), Farmer (believed to be 1,000-mph. fighter-interceptor), Flashlight (believed to be all-weather fighter).

• **Piston-engine bombers.** Box (U. S. A-20), Bank (U. S. B-25), Bob (Il-4), Buick (Pe-2), Bat (Tu-2), Bull (Tu-4 or B-29 type), Bark (Il-2), Beast (Il-10), Barge (undisclosed type).

• **Jet bombers.** Bison (similar to B-52 type), Butcher or Beagle (Il-28), Badger (similar to B-47), Bosun (twin-engine navy bomber), Bear (turboprop bomber).

• **Cargo (all piston-engined).** Colt (An-2), Coach (Il-12), Crate (Il-14), Clam (Il-18), Cab (Li-2), Cart (Tu-70), Crib (Yak-6), Creek (Yak-12), Crow (Yak-14), Cork (Yak-16).

• **Helicopters.** Hare and Hound (undisclosed types).

• **Miscellaneous (utility).** Mule (TO-2), Mink (UT-2), Mark (Yak-7), Moose (Yak-11), Max (Yak-18), Mop, (GST), Mote (MBR-2), Mug (MDR), Mole (undisclosed), Madge (seaplane), Mare (undisclosed), Mist (undisclosed).

• **Miscellaneous (jet types).** Magnet (U-Yak-17), Midget (U-MiG-15) and Mascot (U-Il-28).

ATA Wants Voice in Bilaterals; CAB Endorses Present Procedures

A special Senate Commerce Subcommittee completed the first phase of a review of international air transport bilaterals with a firm endorsement of present procedures by Civil Aeronautics Board's Chairman Ross Rizley and emphasis on the necessity for industry participation by Stuart Tipton, counsel of Air Transport Assn.

Later this year, the subcommittee headed by Sen. George Smathers (D.-Fla.) plans a detailed review of the recently-negotiated U.S.-German bilateral, which U.S. airlines have protested is one-sided in favor of the Germans.

Pointing out that final authority over bilateral agreements legally rests with the State Department as foreign policy representative of the President, with CAB by law the adviser on economic aspect, Rizley commented:

"The Board is firm in its belief that it should oppose anything less than a fair bargain for our aviation interests and that—if there are overriding national policy considerations demanding signature for something less than a fair bargain—the decision to sign must be without our concurrence. However, within the 'fair bargain' standard, the Board has in several cases concurred in a somewhat more liberal grant of routes because of national policy considerations than we would have considered otherwise."

Rizley said a second review opportunity is afforded the Board and the President when a foreign carrier makes a certificate application under a bilateral. He added:

"The Board believes that the present system is a sound one and is operating satisfactorily. It is a system under which the advice of the expert body in the aviation field is sought prior to and during the negotiations for bilateral agreements. It is a system which requires a review of the soundness of the undertaking, upon the application of each foreign carrier to operate. . . . While this review will almost inevitably confirm the action of the government in entering into the particular bilateral agreement, what is important is that there is a review provided in each individual case . . . by the President of the U.S."

Tipton urged that U.S. carriers be able to meet with the Board and the State Department to discuss anticipated negotiations and that they be given ample time to prepare for the discussions. He said the carriers should be permitted to name representatives as part of the government's negotiating teams.

Tipton strongly supported the Bermuda-type bilateral agreement as "the best way to secure the world-wide benefits of air transportation."

Testing of Turboprops Taken Over by MATS

Service testing of turboprop transports has been assigned to the Military Air Transport Service by the Air Force. Original plans for airline operation of the turboprops have been abandoned.

USAF decided to give the job to MATS because the airlines showed only limited interest in the project and submitted bids with costs which were substantially higher than costs of MATS operation.

MATS will operate six turboprop aircraft—two Convair YC-131Cs, two Boeing YC-97Js and two Lockheed YC-121Fs. The YC-131C is equipped with Allison YT-56 engines, and the YC-97J and YC-121F are equipped with Pratt & Whitney YT-34 engines.

The two Convair transports were delivered to the turboprop service test squadron at Kelley Field in January. The other four aircraft are to be delivered by the end of the year. They will be shaken down, then put into scheduled service on the MATS system. The airlines didn't feel the program offered enough to warrant any special effort to obtain the turboprop transports for operation. Apparently they will depend on what information they can get from MATS on the results of the experimental program.

One major airline executive told AVIATION WEEK: "We didn't get into the turboprop test program because we weren't interested in anything in it—aircraft or engines. There wasn't anything we could learn. The equipment would have no application on what we're flying now or intend to fly in the future. I believe this was the reaction of all other airlines.

"If we had taken on the program, it would have meant setting up a separate airline inside an airline, and we would have lost some money on it. The Air Force attitude seemed to be: 'Here's a chance for you guys to acquire some turboprop experience.' So we replied: 'We've got enough problems of our own.'"

Aviation Backlog

Backlog of orders for complete aircraft, engines and propellers as of Mar. 31, 1955, declined 5 % below the orders on hand at the end of December 1954.

Backlog for quarter ending Mar. 31, 1955:

(in millions)

	March 31, 1954	June 30, 1954	Sept. 30, 1954	Dec. 31, 1954	March 31, 1955
Total	$16,187	$15,310	$14,927	$14,852	$14,055
Completed aircraft and parts	11,376	10,671	10,486	10,639	9,936
U. S. military	10,657	10,004	9,821	9,868	9,161
Other	791	667	665	771	775
Aircraft engines and parts	3,619	3,378	3,269	2,929	2,638
U. S. military	3,472	3,251	3,149	2,806	2,502
Other	147	127	120	123	136
Aircraft propellers and parts	193	206	202	187	179
U. S. military	169	180	174	161	154
Other	24	26	28	26	25
Other products and services	999	1,055	970	1,097	1,302

ANDB Receives First Of 3 Tacan Reports

Air Navigation and Development Board last week received the first of three reports aimed at learning the "unknowns" of Tacan, a short range air navigation system developed by the military.

The initial report, prepared by ANDB's Advisory Committee No. 3, determined for the first time the coverage requirements the Tacan system must meet in the continental U.S.

ANDB has set Nov. 1 for completion of the final two reports. They are being handled by the Boulder Laboratory of the National Bureau of Standards and Airborne Instruments Laboratories, Inc. These two studies involve the channel availability and requirements of Tacan. The ANDB evaluation of Tacan is independent of the military's promised declassification of the system.

At IAS Meeting

Under Conventional Lines

Bell X-2 Masks Unconventional Design

The conventional lines of the Bell X-2 rocket-powered supersonic research aircraft, shown in these first pictures, mask unconventional design ideas aimed at getting maximum performance out of the tiny airframe.

By replacing wheels and landing gear with a flat skid system, Bell engineers were able to pack more fuel in the space usually reserved for the retracted landing gear. Use of stainless steel for wings and tail and K-Monel for the fuselage was dictated by temperatures expected in flight as the X-2 pushes far into the supersonic speed range.

Highly tempered glass capable of taking almost 1,000F, was used for the windshield. The glass also cuts down on transmission of infrared radiation to protect the pilot from serious sunburn.

The jettisonable cockpit is heavily insulated and pressurized. In an emergency, the pilot separates the cockpit by actuating explosive charges. A ribbon chute takes the complete cockpit section to a lower altitude where the pilot can make an over-the-side bailout.

Primary purpose of the X-2 design is to extend the speed range of the earlier X-1 series of research aircraft. The present top limit is 1,650 mph., or about Mach 2.5 set by USAF Maj. Charles Yeager in December, 1953.

Powerplant for the X-2 is a Curtiss-Wright throttleable rocket engine, running on liquid propellants and rated at approximately 15,000 lb. thrust. Design difficulties inherent in such a powerplant system and its integration into the airframe have delayed powered flight tests of the X-2 for many months. Now USAF says the first powered flight will be made "this year," which leaves about four- and one-half months to make good.

X-2 TEST PILOT Lt. Col. Frank K. Everest fills cockpit of small research craft.

Pilot for the X-2 flight program will be Lt. Col. Frank K. Everest, chief of the Flight Test Operations Laboratory at Edwards AFB, Calif. Flights will be launched from a converted Boeing B-50 bomber in a manner similar to those used for Bell X-1 and Douglas Skyrocket flights. The X-2 is packed with instrumentation and flight recording units.

Built at Bell's Buffalo, N. Y., plant, the X-2 is a co-operative venture of the Bell Aircraft Corp., NACA and USAF.

$9 Billion Transport Market Foreseen

By Irving Stone

Seattle—A comprehensive, and bright, projection of turbine transport requirements in the nine-year span between 1958 and 1966 was spelled out last week for more than 500 engineers, executives and military representatives attending the three-day Second National Turbine-Powered Air Transportation meeting sponsored by the Institute of the Aeronautical Sciences.

Peter G. Masefield, chief executive of British European Airways, predicted that turbine engines—which he said will dominate air transportation in the next generation—will make possible much higher speeds and lower fares "than any of us have ever dared to contemplate before." He envisioned a total turbine transport market over the period of around $9 billion.

Ivar L. Shogran, Douglas Aircraft's chief DC-8 project engineer, told the meeting that the DC-8 should be able to operate profitably on short-haul routes as well as on transcontinental and overseas flights. The DC-8, he said, will be able to operate profitably down to 500-mile stage lengths.

In his address, Masefield said the aviation industry "will have to start thinking of supersonic transport airplanes" within the next two years.

In the overall category of turbine-powered aircraft, he said, the requirement for the nine-year period should add up to 2,700 aircraft costing more than $7 billion with spares. This, he added, would involve 1,800 jet engines and 13,400 turboprop engines.

Omitting the DC-3 replacement types and the turbine-powered copter, there would be a requirement for 300 jet planes with 1,200 engines, compared with 1,300 turboprop aircraft with 5,200 engines—a four-to-one ratio in favor of the turboprop. Dollarwise, these jet transport orders would come to $1.8 billion as opposed to $4 billion for the turboprop—better than two-to-one ratio over the nine-year period.

Here are the categories of planes in Masefield's projections:

• **Blue ribbon long range jet** designed to fly non-stop across the American continent and from London to New York. This plane will cruise at about 550 mph., carry about 100 passengers. A world market for about 200 of these aircraft will exist—an investment of about $1.5 billion with spares. Gross weight of the plane will be about 300,000 lb. Only contenders in this plane category appear to be the Douglas DC-8 and revised Boeing 707.

• **Long range turboprop transport.** Only contenders in this category appear to be the Bristol Britannia and the turboprop version of the Lockheed 1649. This type aircraft, capable of the same non-stop hops as the long range jet, would cost about 20% less, be 100 mph. slower. It would carry the same sort of payload—about 20,000 lb., or 100 passengers. Gross will be about 180,000 lb.; cost about $3.5 million each. World market for about 400 of these turboprops is seen, also worth about $1.5 billion with spares. Flying parallel with the blue ribbon jets, fares on the long range turboprop will be cheaper than those of the jets.

• **Medium range jet.** Market for this plane—a 70-passenger 150,000-lb. 500-mph. configuration capable of flying about 2,000 miles non-stop—will be somewhat restricted. This plane will sell about 100 units and cost about $2.5 million with spares. Masefield said the de Havilland Comet 4 will be in this category.

• **Medium range turboprop** represented by the Lockheed Electra and the Viscount successor. Plane will carry between 70 and 90 passengers and cruise at better than 400 mph. It will gross about 100,000 lb. and cost under $2 million each. He believes there will be a world market for at least 500 of these planes—representing an investment by the airlines of about $1.5 billion.

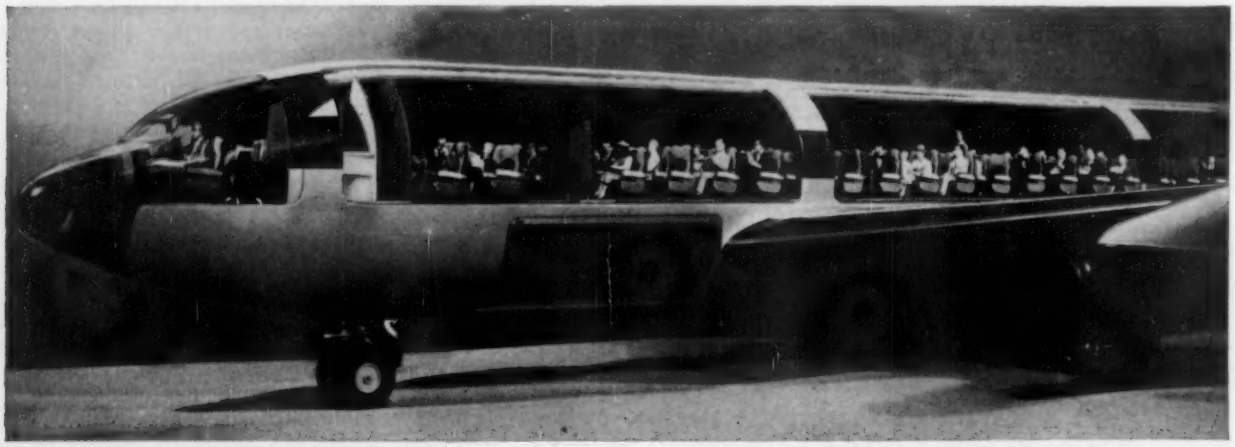
• **Medium and short-haul workhorse turboprop.** World demand for this type will be about 400 units costing about $1 million each—representing about $600 million worth of aircraft and spares. Plane will carry between 50 and 60 passengers at cruising speed of 350 mph. Gross weight would be about 65,000 lb. Chief contender in the category is the Viscount Major, the V-800 series with boosted Dart engines.

• **DC-3 replacement.** Masefield sees in this category a demand for not less than about 600 aircraft worth about $350 million with spares. There is no plane yet designed to fit this category. Masefield predicted it will be a relatively small four-engine plane, preferably using turboprops of about 600 or 700 hp. each.

707 Dive Tests

Seattle—Boeing engineers told the IAS meeting here that the jet 707 prototype has been dived at 12,000-14,000 fpm. at full power in investigations of its high speed and dive characteristics.

They said this phase of the program was very difficult to accomplish with the F-86 chase plane used in the program. Boeing expects to use an F-100 later.



PLANNED interior of Boeing 707 jet transport is revealed in company mockup. Five-abreast seating provides for 108 passengers.

It would cruise at about 280 mph., carry approximately 30 passengers. Gross weight would be about 20,000 lb.; cost about $400,000 each.

• **Long multi-engine copter.** Powerplant would embody two or perhaps four turboprop type engines with a total of not less than 6,000 eshp. Masefield feels that if such a copter can be produced in the next 10 years, then at least 500 would be sold at a market value of more than $1 billion dollars. The configuration would have about 50 seats and cruise at not less than 150 mph. at 60,000 lb. gross weight. It would cost not less than $1.5 million.

Shogran said the DC-8, had been designed to be operationally practical on such routes as New York-Chicago and San Francisco-Los Angeles where the traffic potential is high.

Passenger-mile costs of the DC-8, it was said, will be 25% lower than that of the best piston-powered airliners on routes as short as 550 miles.

Speed of the DC-8 will be over 554 mph.

DC-8 Specs

Specs revealed for the DC-8: length 140 ft. 6 in.; height, 40 ft. 2 in.; fuel capacity, 13,338 gal. domestic, 18,538 gal. overwater; passengers 103 domestic, 125 overwater; cargo volume, 1,253 cu. ft. maximum gross, 211,000 lb. domestic, 257,000 lb. overwater; wing area, 2,594 sq. ft.; span 134 ft. 6 in.

J. A. M. Lecarme, technical advisor and test pilot on the French Sncase twin-jet Caravelle 210 project told the meeting that the plane, which first flew in May, has shown many advantages in the rear fuselage-pod arrangement for the engines. Air intakes show high efficiency. Wing design is not compromised, since it does not depend on the location of the engines and is an uninterrupted torsion box.

Charles W. Carmody, Chief of the Civil Aeronautics Administration's operational procedures branch, said it is possible that future turbine powered aircraft will be able to operate in complete compatibility with other traffic.

R. D. Kelly, United Air Lines superintendent of technical development, explained that the work capacity of a 100-passenger jet plane at 500 mph. block speed would be 50,000 passenger miles per hour. This obviously increases an airport's passenger capacity. He emphasized the importance of efficient ground handling by pointing out that one minute of ground delay represents a potential loss of 9 flight miles.

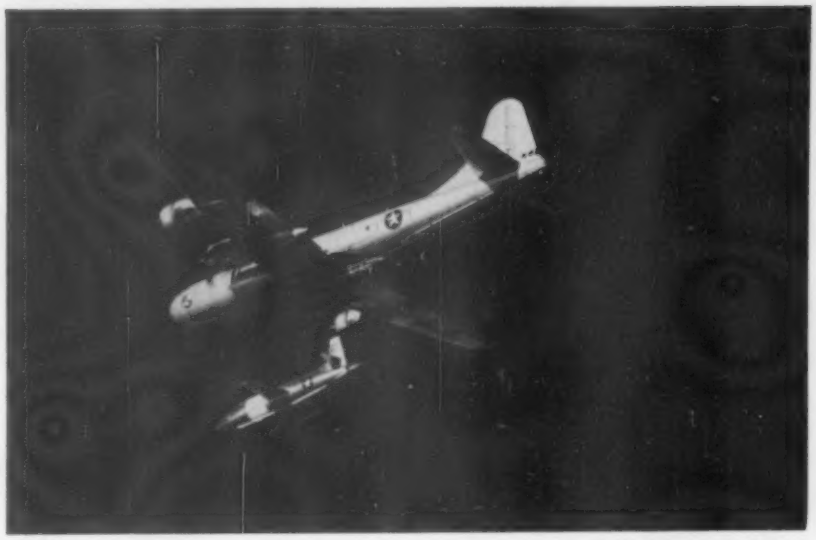
Water-Based Turbojets

Large water-based turbojet aircraft in the transport field came in for discussion by Chauncey F. Bell, of the Glenn L. Martin Co., who declared that water-based aircraft are now as fast as land-based planes. Tests on the long afterbody hull form at NACA have indicated that critical drag rise can be delayed beyond Mach. 0.9.

Studies of an aircraft similar to Martin's XP6M-1 SeaMaster but embodying a considerable increase in size to meet the payload-range-volume requirements of a large cargo logistics transport "indicate that it will bow to no transport in the matter of speed."

With improved beaching gear, docks and other equipment now under development or construction, Bell predicted takeoff and beaching operations in the 5 to 10 minute range within the next few years. Such performance, he said, will outstrip the land-based aircraft on both counts.

Commenting on water-based aircraft, BEA's Masefield made a plea for flexibility of mind. The problem of ice with this type of aircraft, he said, is a serious one. Gander or New York harbors in winter would be a big problem.



BELL X-1A, destroyed last week after explosion, shown in earlier flight from mother B-29.

Bell X-1A Explodes Over Mojave; Is Jettisoned From Mother Ship

Los Angeles—The world's fastest and highest-flying rocket airplane, the Bell X-1A, exploded in its B-29 mother plane 30,000-ft. above Edwards Air Force Base early last week. As a result, the pilot of the mother ship was forced to jettison the $1-million X-1A.

Pilotless, it fell to destruction on a bombing range in the Mojave Desert.

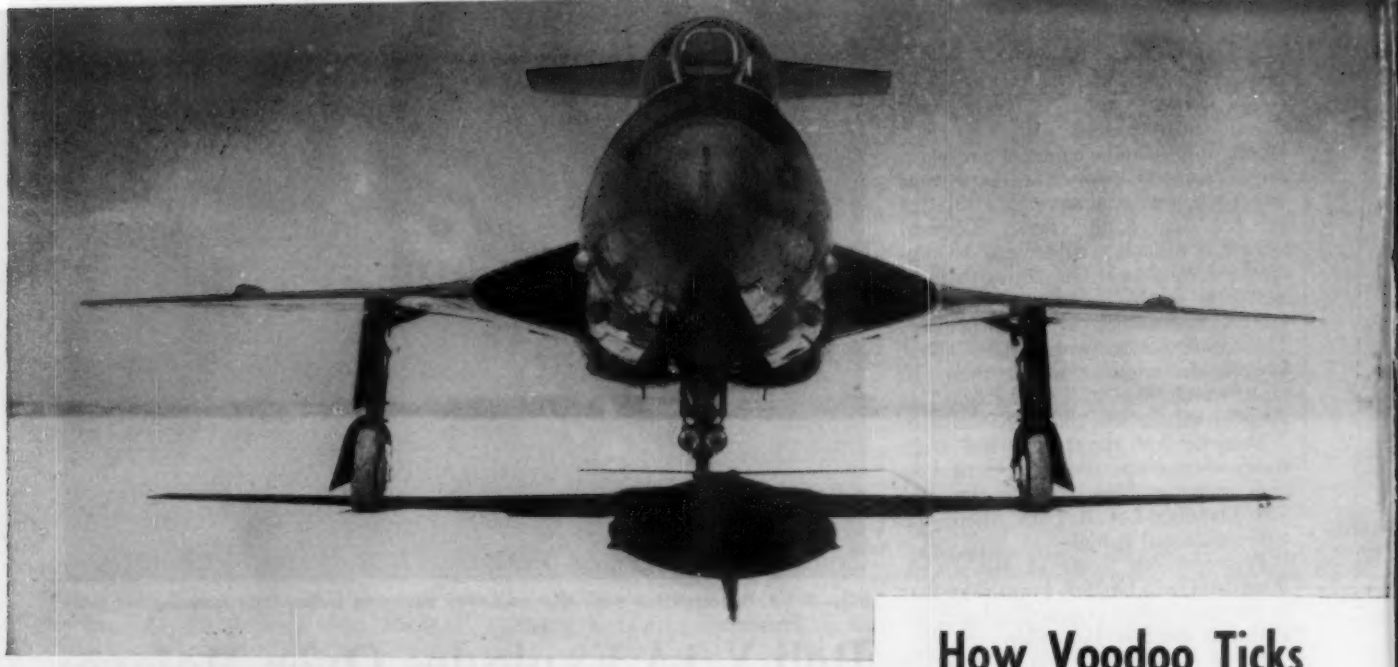
The Air Force said the explosion in the X-1A occurred only 70 seconds before its scheduled release from the B-29. Research Pilot Joseph A. Walker scrambled safely from the rocket plane cockpit into the mother ship. The B-29 was not damaged.

An investigation to determine the cause of the accident was begun immediately, according to a spokesman for the National Advisory Committee for Aeronautics, the government agency conducting research on the experimental rocket plane.

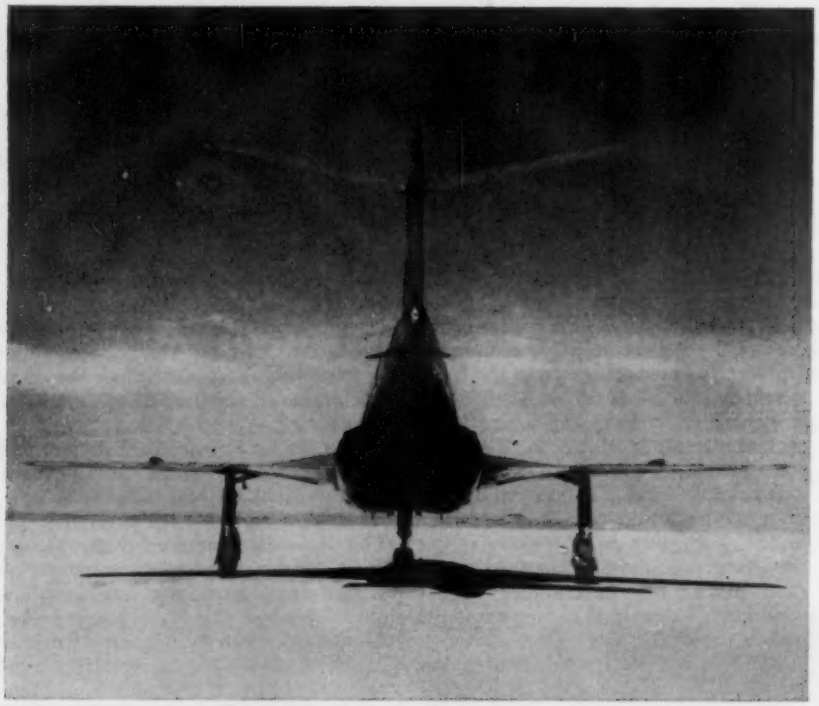
Maj. Arthur Murray was flying chase for the B-29 and X-1A test flight. The force of the explosion nearly blew the canopy off his F-86. He flew in close to the suspended X-1A to observe the damage.

After the explosion, Walker turned off all the cockpit switches and quickly began emptying the rocket fuel before escaping. Noticing that all the fuel—including highly volatile hydrogen peroxide—had not drained, Murray notified the B-29 pilot. It was then that the decision was made to drop the X-1A for fear of another explosion which could have destroyed the B-29 and imperiled the lives of its eight crew members.

The rocket plane held two world records. In the winter of 1953, the X-1A, piloted by Maj. Charles Yeager, set a world speed mark of 1650 mph. The following summer, Maj. Murray flew it to a new altitude record of 90,000 ft., a mark that remained unofficial because the plane was launched in mid-air from a B-29 at an altitude of 25,000 ft. to 30,000 ft. Records are not recognized by the Federation Aeronautique International unless the flight starts at sea level.



How Voodoo Ticks



Extremely thin wing and 20,000-lb.-plus thrust of twin PWA J57s are two major reasons for supersonic performance of McDonnell's F-101A Voodoo, under development for USAF as an interim long range interceptor (AW, Aug. 8, p. 13).

Task requirement for the F-101A originally was as long range escort for SAC bombers but later was changed to interception to meet immediate threat of Red subsonic bomber fleet. Combat radius is large enough to permit attack on bomber fleet well ahead of U. S. borders.

Visible in new pictures, taken during flight test program at Air Force Flight Test Center, Edwards AFB, Calif., are:

- Thin wing, estimated at approximately five percent thickness-chord ratio.
- Midspan ailerons, to avoid possible aileron reversal from wing twist at high speeds.
- Afterburners on Pratt & Whitney Aircraft J57-P-13 turbojets.
- Duct splitter just inside inlet to turn air with minimum loss; boundary layer bleeds at fuselage side.
- All-flying tail, operating over large angles of incidence.
- Four 20-mm. cannon for main armament; other external stores can be carried.

First flight of Voodoo experimental prototype on Sept. 29, 1954, was supersonic. Wingspan is 39.7 ft.; length 67.4 ft.; height 18 ft.

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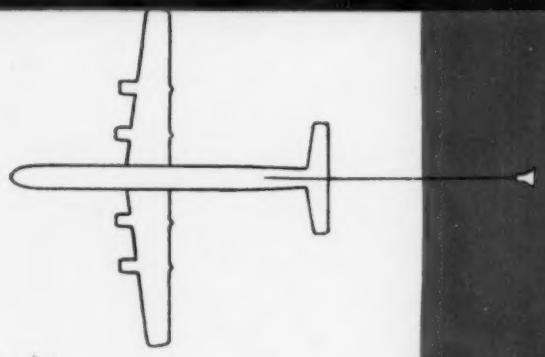

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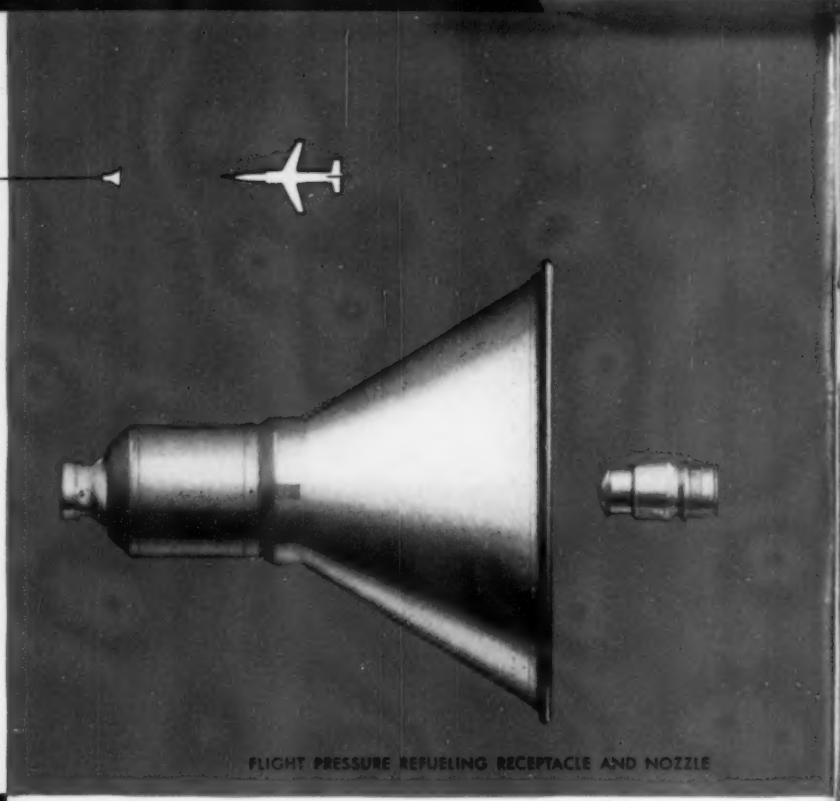

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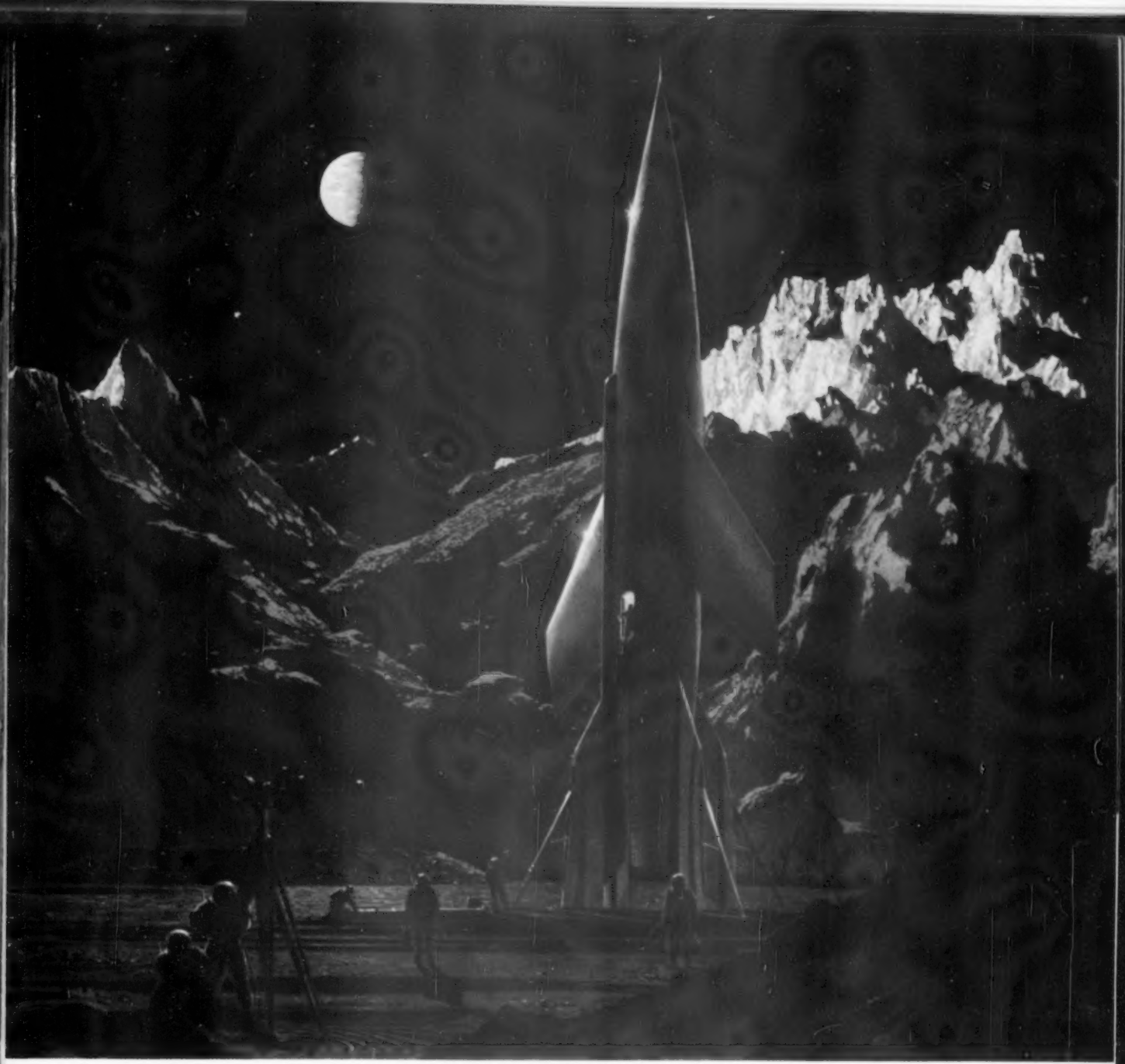

Painting by Chesley Bonestell from the book *The Conquest of Space*, by Willy Ley and Chesley Bonestell, published by the Viking Press. © C.B.

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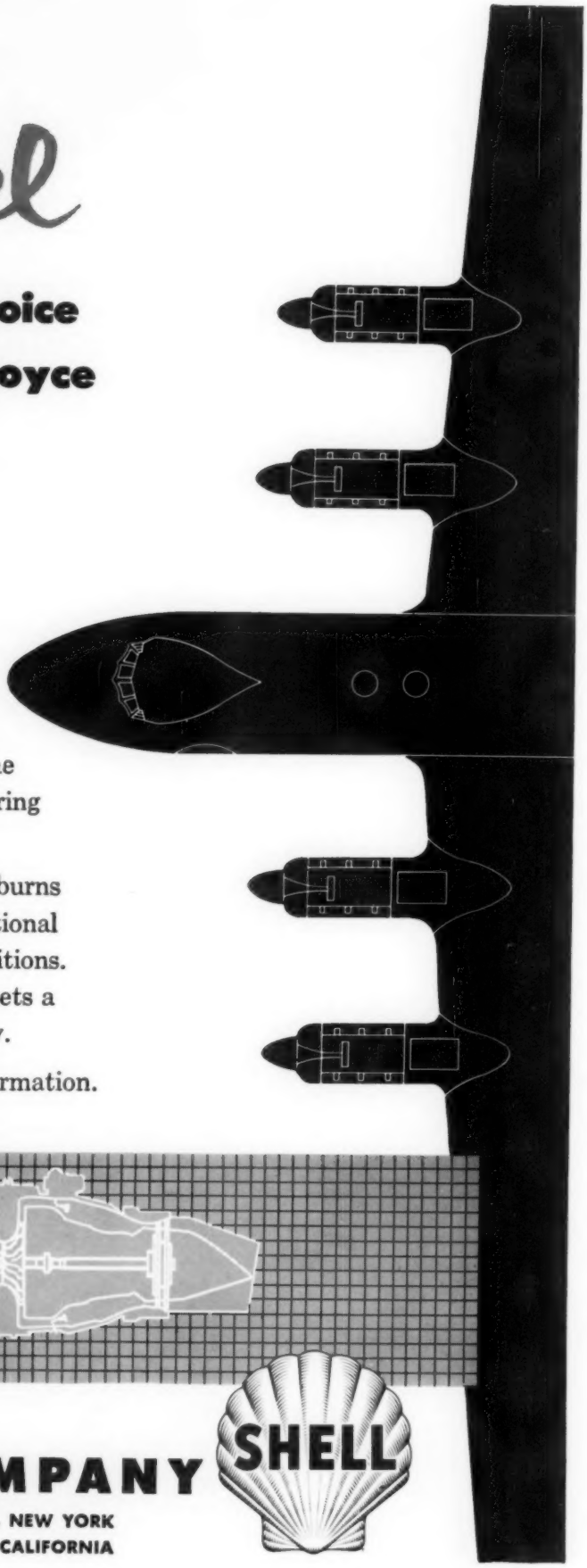

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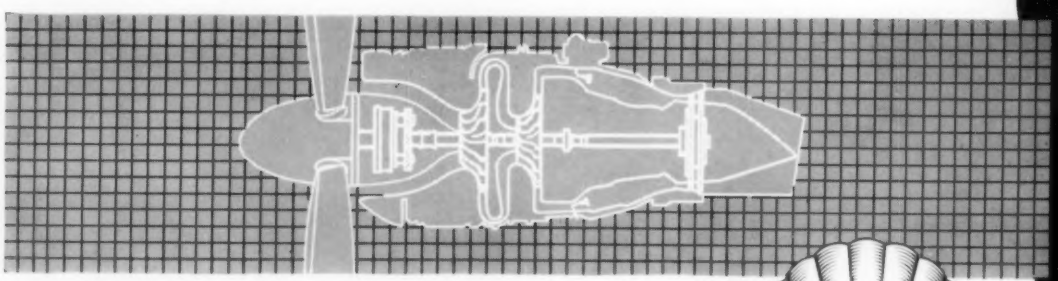

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Larger Satellites Predicted Soon For Government's IGY Proposal

San Diego, Calif.—The United States space satellite project probably will move quickly to objects larger than the basketball size mentioned in the government's original announcement (AW Aug 8, p. 14), says Dr. Charles L. Critchfield, director of scientific research at Convair Division of General Dynamics Corp., San Diego, Calif.

"That was probably meant as the smallest possible object that would be of interest," Critchfield believes. "It would deliver only primitive information."

Critchfield left little doubt that Convair, contractor on the Atlas intercontinental ballistic missile, is interested in participating in the space satellite proposal for the 1957-1958, International Geophysical Year.

Among other firms which have been actively engaged in studies are Douglas Aircraft, whose El Segundo Division conducted the original Forrestal study in 1948, and Lockheed Aircraft Corp., whose guided missile division is making satellite studies.

Aerojet-General Corp.'s president, Dan Kimball, said only a few weeks ago that his company is prepared to start immediate construction of a satellite vehicle (AW July 11, p. 14). "We can give them a delivery date and a fixed price on a contract," he said.

More recently, Lear, Inc.'s Bill Lear has stated that his firm "definitely will participate" in the construction of a space satellite.

Powered Satellite

Dr. Krafft A. Ehricke, a design specialist in the guided missile development group at Convair, has suggested that a weakly powered satellite might be placed in a lower orbit than that required for an unpowered satellite. Ehricke coined the word "satelloid" to distinguish this vehicle from an unpowered satellite. His comments came in a paper prepared for delivery at the International Astronautical Federation meeting that was held in Copenhagen, Denmark.

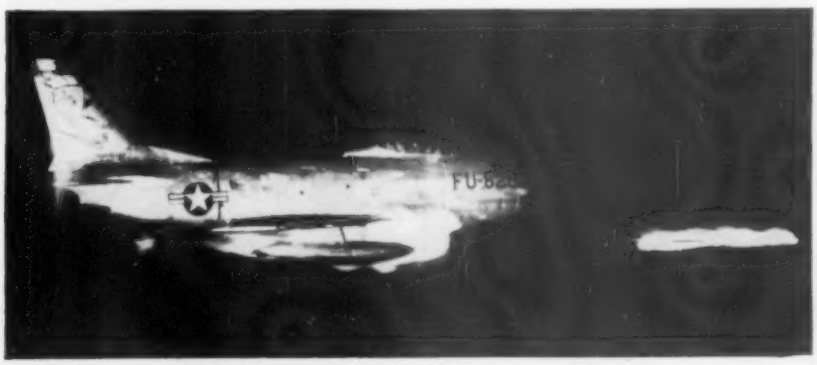
Critchfield estimated that 100 miles would be the minimum altitude for an unpowered satellite, with 200 to 400 miles more likely. Ehricke said a "satelloid" might be placed at an altitude of about 80 miles.

In regard to the 18,000-mph. speed required of a satellite, Critchfield said, "theoretically, there is no reason we cannot produce this speed. It is a question only of the magnitude of the effort."

"The only thing to get it up there is rockets," the Convair research director said. "Nuclear energy could do it theoretically, but I will be astonished if nuclear rockets are in existence in 1958."

Critchfield pointed out that it would be more desirable to place the satellite in an orbit over both Poles, rather than an orbit parallel to the Equator. In this manner, all countries on the earth would be covered by its path.

The basketball-sized satellites themselves, together with the scientific instruments installed, might cost no more than $20,000 each, he estimated. Remainder of the $10-million sum announced by the President would go for establishment of scientific stations around the globe to maintain contact with the satellite. The propulsion sys-



Sabre Fires Rockets at Night

North American's F86-D Sabre Jet is shown firing its rockets in this first in-flight night air-to-air picture. The "Mighty Mouse" rockets are fired from the jet's pod at a speed over 2,000 mph. The picture was taken from a two-passenger Lockheed T-33 jet trainer traveling at about 350 mph. over Selfridge AFB by using three No. 31 G-E flashbulbs in a cluster and a speed graphic camera.

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tem requires a much larger investment, of course.

Satellite Benefits

Critchfield listed these possible benefits from the initial project:

- **Radar tracking** would give an accurate measurement of the satellite's travel, which in turn would indicate the nature of the atmosphere at that altitude.
- **Telemetering** could supply cosmic ray information.
- **Measurement of heat flux,** perhaps with an infrared detector reporting by radio, would supply information for long range weather forecasting.
- **Reports on the sun's spectrum** would provide an over-all look at radiation in space.
- **A pole-to-pole orbit** would permit measurement of the earth's magnetic fields.

"Length of its stay in its orbit depends on the amount of air at that altitude and that we don't know yet," Critchfield said. Time required for the satellite to travel from horizon to horizon would be 20 minutes, the scientist said.

While invisible to the naked eye, the satellite would be visible through large telescopes.

However, the rocket that carries the satellite into its orbit probably will be visible to the naked eye, since it too will follow the same flight path for a brief period, Critchfield said.

"If what takes it up there is big enough, it will be visible at sunrise and sunset. It will appear as a fast-moving light in the sky," the Convair research director commented. Once the larger object falls away due to greater drag, the "basketball," itself will not be visible, he said.

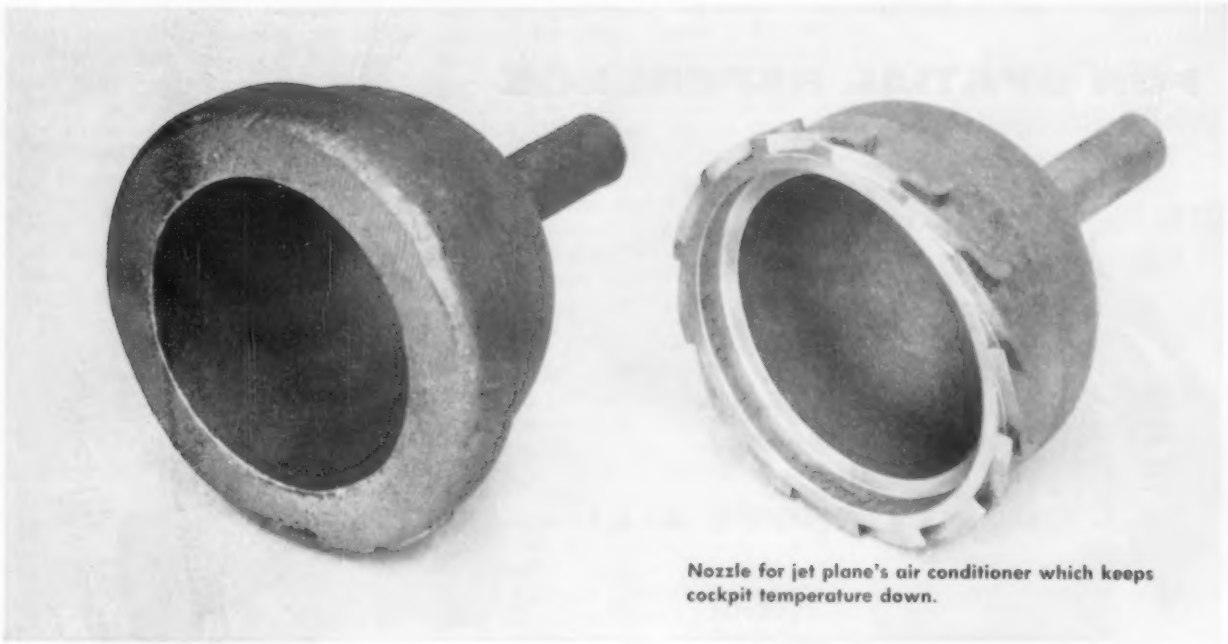
Critchfield made it plain that he regards the satellite project as entirely feasible. "This is the first step to interplanetary travel," he told AVIATION WEEK.

Satelloid Details

Ehricke said that "because of its limited propellant supply, the satelloid cannot stay up for a year or more, like a satellite." However, it can maintain its orbit for a number of days at altitudes where a satellite would not be able to stay for hours.

"The satelloid, therefore, holds good prospects for a manned upper atmosphere research vehicle and potentially is a significant step in the development of manned space flight," Ehricke further stated.

Externally, the shape of a manned satelloid is determined by the fact that the vehicle must be able to return to the earth's surface after exhaustion of its propellant supply, the Convair scientist said. He gave this description



Nozzle for jet plane's air conditioner which keeps cockpit temperature down.

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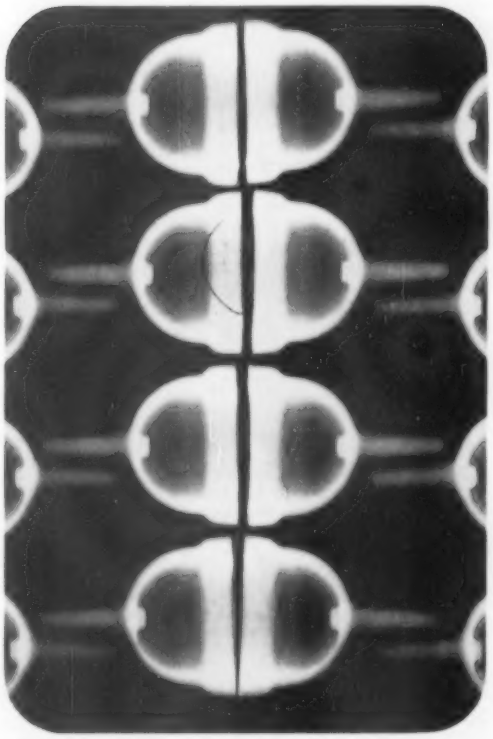

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of a possible "satelloid" vehicle:

Its external configuration would be essentially that of a very-high-speed glide plane with adequate surface protection against aerodynamic heating. For a crew of one with research equipment, empty weight would be 10,000 lb. or less. Assuming 10,000 lb. and a wing area of 500 ft., the satelloid would consume about 34 lb. of propellant for each circumnavigation of the earth, if its altitude were about 400,000 ft. and its speed equal to that which a satellite would have at that altitude, 17,400 mph.

It would use about 4 gal. of fuel for each revolution, completing its circuit in 1.44 hr. under these conditions, with 3400 lb. of propellant on board initially, it could stay in its orbit for six days before its propellant supply was exhausted.

US Grants Aid For NATO Light Fighter

Development of three new light fighter planes by France, Italy and Britain for the NATO forces will be made with the support of a U.S. grant of $12.6 million under the Mutual Weapons Development Program.

The MWDP agreements provide for:

• **France receiving** approximately $5 million toward the cost of constructing three prototypes each of two designs, the Breguet Taon 1001 and the Dassault Mystere XXVI. In addition to paying the remaining costs, France will provide inspection and various technical services.

• **Italy getting** about $2.3 million for the pre-production programming of 27 additional Fiat G-92's. Another $1.3 million has been allocated for the development of Italy's newly designed Ariete light interceptor aircraft.

Both of the French designs as well as the Fiat G-91 design will be powered by the Orpheus turbojet engine being developed by the Bristol Aeroplane Co., Ltd., of Britain and for this project $4 million was allocated as the U.S. share of the cost.

The defense announcement stated: "These joint agreements made by the United States with Italy, France and the United Kingdom, will assure a full and logical development program designed to fill the NATO requirements. The selection of the Fiat, Breguet and Dassault airframes and the Bristol engine was based upon a detailed technical study of various proposals conducted under the sponsorship of NATO's advisory group for aeronautical research and development. When the prototypes of all three designs have been technically evaluated a final decision will be made on production."

National Uses Instant Reservation System

National Airlines plans to begin use of an automatic reservations system next fall with an initial installation of equipment manufactured by Teleregister Corporation in the airline's New York ticket offices.

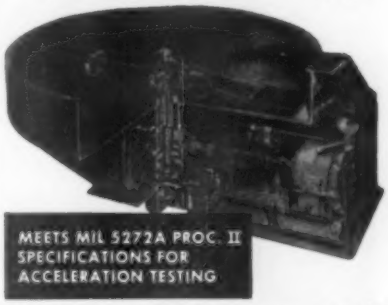
The Teleregister system is capable of handling 3,600 inquiries per hour and will enable National to supply passengers with instant reservations information along with flight departure and arrival notices.

Facility For Simultaneous Jet Engine Tests

"Hush House", a noise suppression testing building, is being used at Martin, Baltimore to test jet engines. Arranged to permit simultaneous testing of two J-71 engines used in the ZP6M-1 seaplane, the structure is made of precast concrete columns, wall and roof panels and steel roof beams to facilitate possible future expansion. The facility was designed by Industrial Sound Control Inc., Hartford, Conn.

GENISCO MODEL B G-ACCELERATOR

A precision centrifuge for testing reliability of electronic components under simulated operational G-loadings



MEETS MIL 5272A PROC. II SPECIFICATIONS FOR ACCELERATION TESTING

Simple operation—To operate, simply mount test object, connect slip rings and accessories, push "start" button and turn handwheel to desired r.p.m. Quick, easy operation makes the Model B particularly suited to large quantity test programs.

Extreme accuracy—The Vickers Hydraulic Transmission provides smooth, constant boom rotation over full r.p.m. range. Wow is less than 0.5% of set speed above 10 r.p.m. Drift at any set speed above 10 r.p.m. is less than 0.1% per minute.

R.P.M. easily measured—A tachometer and timer and counter for measuring rotation rates are standard equipment. A strobe unit which measures exact boom speed (within accuracy of line frequency) at 90 settings over the full r.p.m. range is available as optional equipment.

G-range of 0.017 to 120 G's—Boom rotation speed is infinitely variable from 5 to 420 r.p.m. Radius of gyration ranges from 19" to 24".

Rugged construction—Heavy cast-and-fabricated structure and adequate safety factors assure maximum operator safety, long life, minimum maintenance.

Now four Genisco G-Accelerators!

MODEL NUMBER	G-RANGE	CAPACITY	RADIUS OF GYRATION
B78	0.017 to 120	25 lbs.—8" cube	24"
C159	0.024 to 75	100 lbs.—24" cube	44"
D184	1 to 800	6 1-lb. objects	12"
E185	0.01 to 60	300 lbs.—30" cube	72"

Optional equipment... additional internal and overhead sliprings, air system, optical system, and other accessories are available for Genisco G-Accelerators. Write to Genisco, Inc., 2233 Federal Avenue, Los Angeles 64, California, for detailed specifications.

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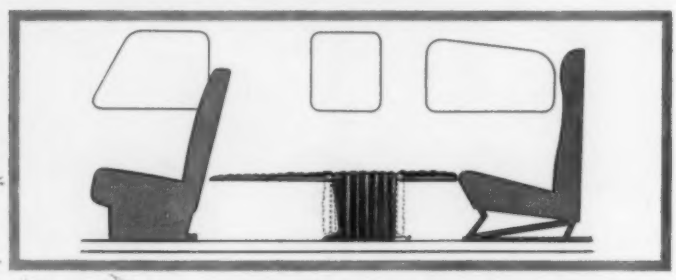
Twin Bed comfort

in the NEW, BIGGER AERO Commander 560-A

LONGER • ROOMIER • MORE COMFORTABLE

Twin-bed comfort is but one of the flexibility features made possible by the longer, roomier cabin of the new 5-7 place Aero Commander 560-A. The optional hassock seat unfolds in seconds to provide a seat back, a chaise longue or a comfortable bed for the flying executive.



For complete information contact your Aero Commander distributor or write for Catalog 128-A

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CAB Rejects Protest On Feeder Service

Civil Aeronautics Board has turned down a request for reconsideration in the Route 106 Case in the latest of a long series of decisions in the proceeding.

Mason City, Ia., complained to CAB that its decision to replace Braniff Airways with Ozark Airlines at that point will result in inadequate service. Mason City claims it deserves trunkline service and asked the Board to reconsider.

Ozark told CAB that Braniff's plans to operate turnaround service between Mason City and Chicago would be competition the Board didn't contemplate in its order replacing Braniff with Ozark.

CAB has denied Mason City's petition for reconsideration and has inserted a restriction in Braniff's certificate which leaves Ozark the only carrier offering one-plane service between Mason City and Chicago.

Action of the majority drew a sharp dissent from CAB Vice Chairman Joseph Adams. He favors allowing Braniff to operate one-plane Mason City-Chicago service rather than restricting the route to feeder service. Adams says that for the first time in history the Board is "foistering upon a city an inferior air service" in replacing trunk service with local air service.

In his dissent, Adams holds that the majority decision is actually contrary to the best interests of the local air service program, since the community will not be inspired to support a program that deprives it of through single-plane service.

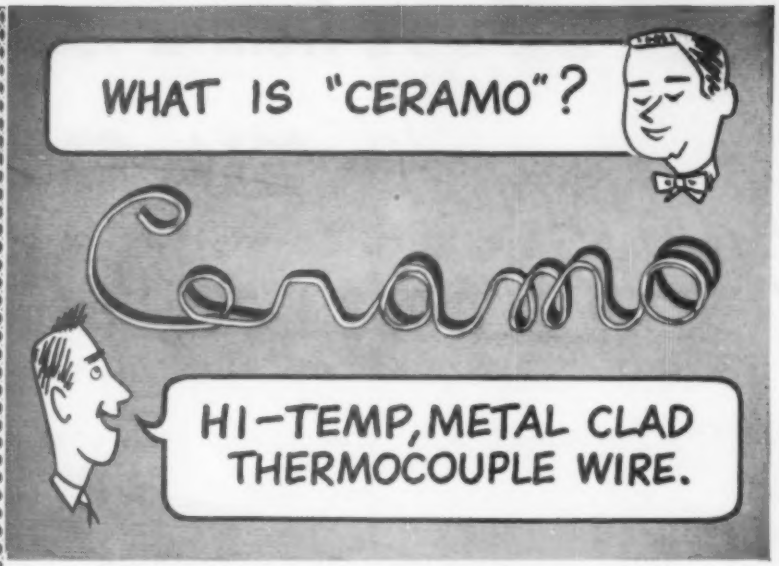
Early Letdown Caused NEA DC-3 Crash

Crash of a Northeast Airlines DC-3 which took the lives of two crew members has been attributed to pilot error in a Civil Aeronautics Board accident report.

The report says the accident was probably caused by a premature and unauthorized descent to an altitude which didn't permit terrain clearance.

The accident occurred on a flight from Boston to Berlin, N. H., Nov. 30, 1954 when the DC-3 struck a mountain about 10 miles southeast of Berlin Airport during an instrument descent. The copilot and a company flight superintendent were killed. The pilot, stewardess and three passengers survived both the crash and severe weather conditions while awaiting rescue.

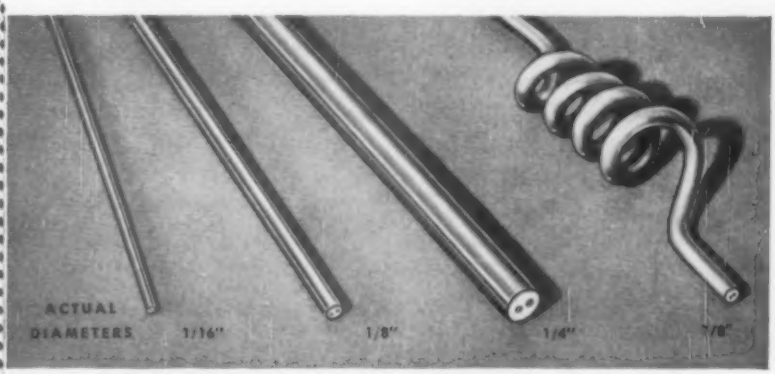
CAB found that the pilot started his descent too early and was attempting a straight-in approach in attempt to get beneath the overcast while short of the airport and ahead of the weather.



T-E's "Ceramo" wire consists of thermocouple material conductors, surrounded by magnesium-oxide insulation, with seamless metal tubing overall.

Thermocouples or extensions made of "Ceramo" wires will fit into openings that are too small for most ordinary thermocouples or extensions. Furthermore, they can be formed easily to any configuration without short-circuiting—in fact, "Ceramo" can be bent on a radius as small as its own diameter. The durability of the outer metal tube makes conduits unnecessary. Not even a hammer blow will injure it; in fact, it will withstand pressures up to 40,000 psi. These metallic clad wires have excellent resistance to high temperature, moisture, chemicals, petroleum products, atomic radiation or abrasion.

"Ceramo" thermocouple wires are made in Iron-Constantan, Chromel-Alumel, Copper-Constantan, Chromel-Constantan, and Platinum-Rhodium Platinum. Wires are sheathed with seamless tubing of stainless steels, Inconel, aluminum, or copper. Made with 30, 22 and 16 gage conductor material; overall diameters of 1/16", 1/8", and 1/4" respectively; lengths up to 30 ft.



"Ceramo" thermocouple extension wires are made in Iron-Constantan, Chromel-Alumel, or Copper-Constantan with copper-nickel alloy, plain or galvanized cold drawn steel sheath overall. Made with 20 and 16 gage conductor material; overall diameters of 1/8" and 1/4" respectively; lengths up to 2000 ft., depending on the type of metal tubing and outside diameter. "Ceramo" is made also in single conductors or multi-conductor cables.

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NOW... from a foremost manufacturer

Lightweight Titeflex flexible hose...

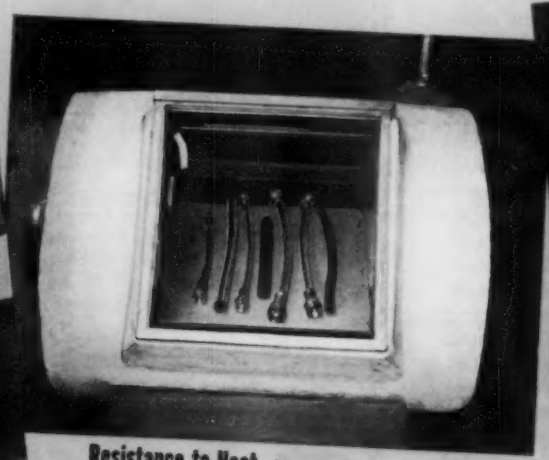
made from Du Pont Teflon*

Titeflex knows the aviation hose business . . . has been making flexible aircraft metal hose for over 20 years. And now . . . to keep pace with the requirements of the jet engine industry, Titeflex has developed a *new* type of flexible hose with an inner core made from Du Pont Teflon tetrafluoroethylene resin.

Our Engineering and Research departments with their specialized experience in hose manufacture, working with all types of metals, now adding special resins, have designed, developed and tested a new product to complement our complete line of metal hose. This is not just a Teflon inner core with wire braid covering, but a completely engineered product from fittings to carefully selected braid and materials.

Working with the designers and engineers of leading jet engine manufacturers, we have developed a flexible hose that meets all practical requirements of MIL-H-5511 specifications under independent testing by a leading research laboratory.

Resistance to Chemicals. New Titeflex hose is impervious to the corrosive action of synthetic lubricants, hydraulic fluids, salt spray; is unaffected by fungus.

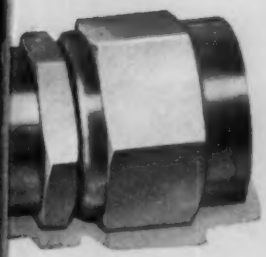


Resistance to Heat. New Titeflex hose withstands temperatures up to 500°F. Does not soften, deteriorate or change in any way under high heat torture.

Resistance to Cold. New Titeflex hose retains its flexibility even at −100°F. Super-cohesive—will not crack, chip or cause fuel or oil lines to clog.

*Du Pont trademark for its tetrafluoroethylene resin

# of Aviation Metal Hose—



Chief Characteristics

- **Has high resistance to synthetic lubricants, hydraulic fluids**
- **Withstands extremely low temperatures**
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- **Virtually chemically inert**
- **Will not crack, chip; will not cause lines to clog**
- **Has indefinite shelf life**
- **Available in ¼" to 1¼" sizes with standard fittings**

For any conveying application where increasing high pressure and high temperature requirements combine to make most other hose assemblies either uneconomical, too bulky, inefficient or obsolete . . . this latest addition to the Titeflex line of flexible hose offers a practical solution to one of the aviation industry's serious design problems. Use the coupon at right to obtain additional information or request one of our sales engineers to discuss your specific application.

Titeflex

Resistance to Pressure. New Titeflex hose is tough — recommended operating pressures range from 600 psi for 1¼" hose to 3000 psi for ¼" hose. Shows no visible effects from aging, and has unlimited shelf life.

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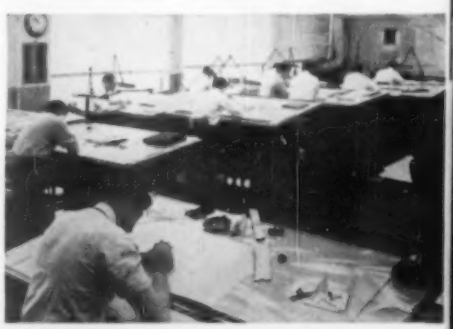

Engineering Service. If you are looking for design ideas, product developments and adaptation of Titeflex aviation hose to your own specifications, call on our highly skilled engineering department. No obligation.

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CONVAIR XF2Y-1 SEA DART settles into water of San Diego Bay for single-ski test after shelving of plane's aerodynamic tests.

SEA DART skims across San Diego Bay in high-speed taxi run as Convair records performance data on the single-ski configuration.

Sea Dart Grounded; Ski Study Goes on

San Diego—Aerodynamic testing of Convair's controversial XF2Y-1 Sea Dart has been shelved, but one of the four completed models is being kept in service as a floating laboratory to test the merits of the single-ski undercarriage, shown in the pictures above.

The future of the Sea Dart as a Navy production model has been in doubt since last fall when a prototype model broke up in midair and plunged into San Diego Bay in flames, killing test pilot Charles Richbourg. Sea Dart flights have been made since that time, however, and Convair still has confidence in its plan for sea-based supersonic aircraft.

A company's spokesman, commenting upon the Sea Dart's "grounding," said the next step is to find the "specific piece of hardware" on which to use the ski.

So far as the Sea Dart is concerned, the spokesman said, "Aerodynamically, it is strictly a research vehicle for hydrodynamic purposes."

In Washington, a spokesman for the Navy Bureau of Aeronautics said no statement could be made on the status of Sea Dart tests since all such information is classified but added that the Navy is continuing to investigate all possibilities in the use of hydroskiis.

The one Sea Dart still operating is the prototype XF2Y-1, illustrated here. The other three have been stored and

Sabena Proposes United European

convertiplane, aerial buses or small transports.

NEEDLE-NOSED SEA DART with amphibian single ski taxis from hangar to begin test.

"GROUNDED" Sea Dart blasts its way ashore after taxi and liftoff tests of single ski. Shock absorbers mounted at ski front absorb loads without transmitting vibrations to body.

limited-production contracts for still others have been cancelled.

Convair's present contract with the Navy calls only for another six months of testing on the single-ski configuration. This period will be used to obtain basic design data for engineering of skiis. Testing of the double-ski aircraft has been completed and the plane mothballed.

The company expects further backing for its water-based fighter concept, however, upon the expiration of the present, limited-testing contract.

The company already has a number of proposals for new water-based fighters, based on its experience with the delta-winged XF2Y.

F. Herbert Sharp, military liaison engineer on the Sea Dart project said the tests "have proven definitely that it is practical to water-base a supersonic airplane."

Sharp lists these advantages of the present single-ski arrangement:

• **Less takeoff resistance** because the single-ski parts the water to the sides, rather than throwing it against the belly of the aircraft. This results in better takeoff performance.

• **Simpler, lighter installation** with fewer maintenance problems.

• **Greater adaptability** to tactical requirements of other versions.

• **Less vibration** than the double-ski.

It should be noted that many improvements worked out on the double ski configuration have been incorporated in the single ski now under test.

Single Ski Potential

No definite decision has been reached in the single-ski versus double-ski argument, according to the Convair engineer. "The single ski is better in certain respects and not as good in others," he said. "Some aircraft might make better use of the twin than the single.

But within the limitations of the present program, the single ski appears to have more potential."

Varying oleo arrangements are being tested as part of the program. The purpose of the small shock absorbers which are mounted at the front of the ski in the accompanying pictures is to absorb loads at both ends of the ski without transmitting vibrations to the body.

The test ski shown in the pictures here is a fixed ski.

Lift Offs

Although the flight test program has been shelved, liftoffs and landings are made during the hydrodynamics tests. All three of the Patuxent pilots who took part in the evaluation program made actual flights in both double and single-ski aircraft. For the tests, the Navy assigned one pilot who previously had flown ski-equipped aircraft, one who was a seaplane pilot and one who was a fighter pilot. "All got along equally well." Sharp reports.

U.S. Hydrogen Arsenal Gets Better Weapon

United States is producing hydrogen weapons that incorporate improvements resulting from the 1954 Pacific tests, the Atomic Energy Commission reported to Congress.

AEC said President Eisenhower issued a directive after the tests ordering design changes and that hydrogen weapon production has gone ahead on the basis of the President's directive during the first half of 1955.

The commission gave no indication on what the changes were, how many types of hydrogen weapons are being built or the rate of production.

At the same time, AEC said, progress toward nuclear aircraft propulsion "made greater strides during the first six months of 1955 than in any earlier half-year."

Sabena Proposes United European Helicopter Network At Congress

Rotterdam—Sabena Belgian Airlines wants to join other western companies in the establishment of an extensive and united European helicopter line for short-haul service.

A. V. J. Vernieuwe, director of operations for Sabena, which already operates helicopter routes in its own country and into Germany and France, assured the 200 delegates from 14 countries at the July 29-30 Helicopter Congress that such a plan—receiving support from a number of individual airlines—would lead to a "money-making" operation.

The proposal and short-haul helicopter service in general were subjected to almost immediate attack from Francois Ledeboer, central planning office chief of Sabena's neighbor, KLM.

Mr. Ledeboer told the Congress, held under the auspices of the Rotterdam Helicopter Syndicate, that there "is no justification" for short-haul helicopter service within the Netherlands itself or between cities of Holland and adjoining countries, primarily because of the high cost of operation and the comparatively low return. He added: "Conditions of large-scale operation of scheduled helicopter services in and around Dutch territory during the next few years are unfavorable and the development of the situation will depend on future circumstances."

The KLM executive, who described additional highway and rail connections between airport and city as "the most convenient transport facilities at a reasonable rate," said, however, that KLM may enter into the helicopter field when larger helicopters with lower operating costs are available.

He also noted the recent development of fixed-wing transport planes, such as the Prestwick Twin Pioneer and the Breguet 940, capable of small-airfield takeoffs and landings and said they may "become a competitor of the helicopter."

Helicopter's Future

Other speakers concerned themselves largely with the continuing debate on the future development of the helicopter-single or multiple rotor, pure or convertiplane, aerial buses or small transports.

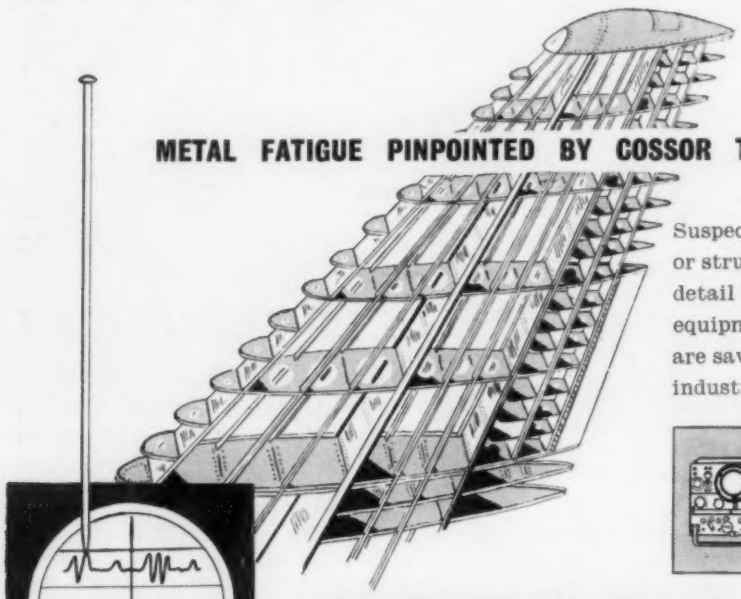
The speakers included Robert L. Cummings, Jr., president of New York Airways; Sergei Sikorsky, European representative of the United Aircraft Corp.; Harry S. Pack, vice president of Piasecki Helicopter Corp.; Paul Morain, of the Societe Nationale de Constructions Aeronautique du Sud-Ouest in Paris; J. Meijer Dress, Rotterdam helicopter designer, and G. S. Hislop, chief designer of the Fairey Aviation Co., Ltd., of Hayes, Middlesex, England.

NYA Costs

Cummings told the Congress that cost per aircraft-mile for his airline amounted to $3.55 for the 12 months ending March 31.

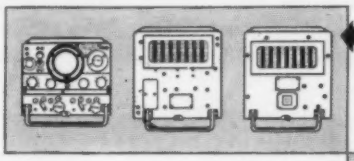
NYA's direct costs now amount to $1.85 per aircraft-mile, he said. He also admitted the overhaul costs on the engines of the airline's five S-55s "are at least three times as high as the overhaul costs experienced on the same engine used in a fixed wing aircraft." This, he said, is primarily because the power plant was not designed for copters.

Sikorsky added that there is no doubt but that the number of blades of the rotor will increase steadily with the size as evidenced by the five-bladed twin-engine S-56 Sikorsky being con-



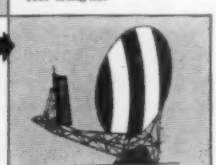
METAL FATIGUE PINPOINTED BY COSSOR TEST EQUIPMENT

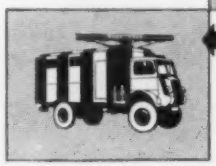
Suspected or unsuspected weaknesses in materials or structures can be detected and analysed in detail by Cossor Oscillographs and testing equipment; these sensitive electronic instruments are saving time and money in the aircraft industry as in many others.



The latest airborne equipment for reliable navigation is the Gee Mk III produced by Cossor for use in the Gee system of hyperbolic navigation. It is used extensively by the R.A.F. and continental air forces and by Aer Lingus.

Now installed at London Airport, Zurich Airport and on Royal Dutch Air Force aerodromes, Cossor Airfield Surveillance Radar (A.C.R. Mk VI) gives permanent echo cancellation, C.R.D.F. superimposition, 60 miles' range and video mapping.





Transponder Surveillance Radar is a Secondary Radar system. This new Cossor development employs a ground interrogator pulse transmitter with an airborne transponder and gives greatly increased operational range.

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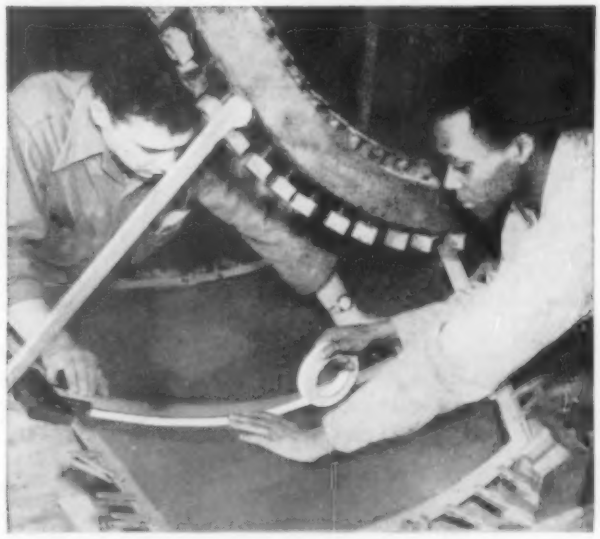
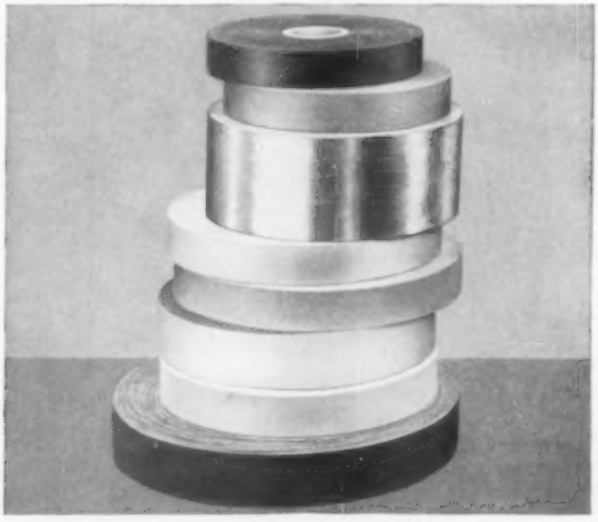
Whatever the job . . .

105 HOWITZER goes aloft by Piasecki-built Army H-21 C Work Horse helicopter—the heaviest load ever carried by a Service helicopter. Same ship carries 20 troops or 2 tons of cargo.



PERMACEL 76 masking tape is used to mask plastic helicopter nose assembly in Piasecki cementing operation. Specially treated to be highly resistant to solvents—does not pit or scar the plastic.

NOSE ON view of a Piasecki-built Royal Canadian Air Force helicopter showing complex plastic sections, the transparency of which was protected by Permacel 76 during cementing.



THROUGHOUT the aviation industry there is a need for every one of the great variety of Permacel tapes—in such operations as protecting, holding, sealing, identifying, stencilling—and more!

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Do the job faster, easier, better with quality self-sticking tape . . . write Permacel Tape Corporation, New Brunswick, N. J.

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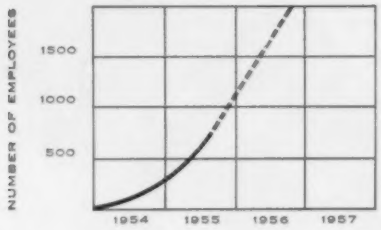
PROGRESS REPORT

After Twenty-One Months...



PROJECTS

Our eight current military contracts support a broad range of advanced development work in the fields of modern communications, digital computing and data-processing, fire-control, and guided missiles. This work is supplemented by non-military activities in the fields of operations research, automation, and data-processing.

FINANCES

In 1954, our first full year of operation, we showed a good profit. Of greater importance, however, are the arrangements recently completed with Thompson Products, Inc., our corporate associate, whereby we are assured additional funds up to $20,000,000 to finance our expansion requirements of the next few years, and insure the long-range stability of the company.

RESEARCH AND DEVELOPMENT PERSONNEL

Total population figures, such as those displayed in the curve, tell only a limited story. Personnel quality factors are most important, in our kind of business. We believe we are doing well in this respect. Of the 90 Ph.D.'s, 65 M.S.'s and 75 B.S.'s or B.A.'s who today make up our professional staff, a gratifyingly high percentage are men of broad experience and, occasionally, national reputation in their fields.

FACILITIES

By mid-1956 our Los Angeles facility will consist of seven buildings totalling 300,000 square feet of modern research and development space. Two of the three buildings now complete and occupied are shown at bottom of this page; a fourth and fifth are presently under construction, the others are in the design stage.

MANUFACTURING

We are somewhat ahead of the usual systems development schedule, with some of our projects having arrived at the field and flight-test stages. We are now planning a facility for quantity production of electronic systems. Construction on the initial unit of 160,000 square feet (shown above) is expected to start in late 1955, with manufacturing planned for late 1956.

The Future

Our first year and a half of corporate history encourages us in the belief that our future will be one of expanding productivity. But whether we remain a small company or grow large, we plan not to lose sight of the fact that the continued success of The Ramo-Wooldridge Corporation depends on our maintaining an organizational pattern, a professional environment, and methods of operating the company that are unusually well suited to the very technical, very special needs of modern systems development and manufacturing.

The Ramo-Wooldridge Corporation

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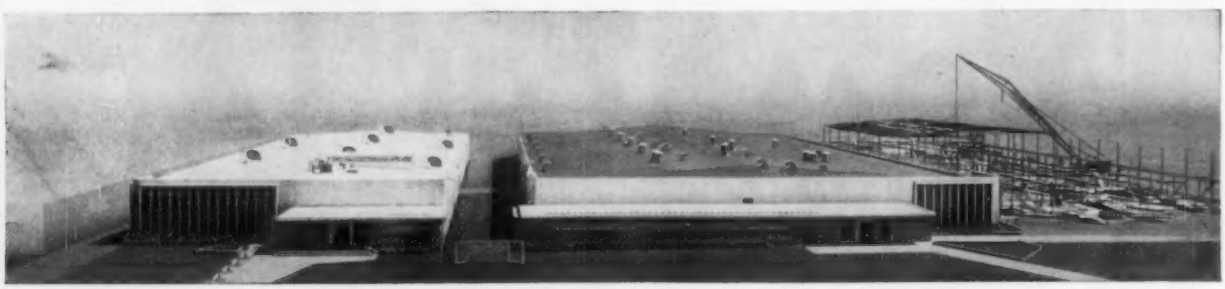

structed for the U. S. military services.

For the future, he observed that:

- **The pure helicopter** probably will continue as the primary short-range transport vehicle and inter-city transport medium. It probably will attain a maximum speed of about 188 mph.
- **Compound helicopters** with added wings and tractor props or jets will be able to get some 46 to 63 mph. higher speed but at a sacrifice of payload due to added weight of wings, power plants and fuel.
- **Size of helicopters** will be limited by practical and economical factors rather than technical ones. The larger helicopters will be needed in limited quantity for certain military and civil roles.

Morain, chief of the helicopter department of the Societe Nationale, declared that for the next 10 years, at least, "The technical formula of the helicopters will keep to the line of development now recorded by the facts." Afterwards, he said, new types probably will appear but "the helicopter as we know it today always will remain, because for certain purposes its intrinsic qualities seem irreplaceable."

The tendency to simplify shapes and structures, he said, is in favor of the single reaction rotor.

"At this moment," he added, "there is much talk about boundary layer control by sucking or blowing." This method has only a very moderate effect, singularly complicates the construction and is very difficult to introduce into a thin profile. If it should turn out to be really efficient, it would have to be applied first of all to reaction rotors which already have compressed gas pipes in their blades."

Bright Future

Despite current high costs, Mr. Cummings predicted a bright future for helicopters in the transportation field.

He warned, however, that the present noise level must be "radically reduced."

"If this does not happen," he said, "it is not an overstatement to say that the helicopter will never realize the useful future that is being so enthusiastically promised by the designers, manufacturers and operators. Some other type vehicle with vertical flight ability will inevitably replace it."

He added that "the immense short-haul market that is seen to lie in front of an aircraft with vertical lift ability is no illusion . . . it is a market which, when properly exploited, will far exceed anything that has yet been found in the field of transportation. It waits only on technological advances which, for the most part, already are under way.

As to future helicopter configuration, Sikorsky intends to stick to the single

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rotor "for some time to come," Mr. Sikorsky told the Congress.

"Personal opinion and a certain experience," he said, "has made us believe in the single-rotor helicopter as the best all-round solution. . . . There are no reasons to drop the single rotor configuration as size increases."

Convertiplane

Hislop of Fairey Aviation, said he looked upon the convertiplane as the economical answer:

"For an area such as Western Europe where short haul transport by air has yet to be fully exploited, the premium is placed on a fast, economical rotary-wing transport. My opinion is that this can best be achieved by an aircraft of the convertible or compound-helicopter type."

Pointing out that to be at all economical such aircraft would have to be operated at high speeds, Hislop said weight should be transferred from the rotating wing to a fixed wing. Fairey is now building such an aircraft—its twin-engined Rotodyne scheduled to be in operation by next year—Hislop told AVIATION WEEK.

"Several favorable consequences in rotor head design," he said, "follow from the use of a fixed wing in that the rotor flapping can be reduced to a very small amount indeed—sufficiently to eliminate that great bugbear of rotor head design, the drag hinge.

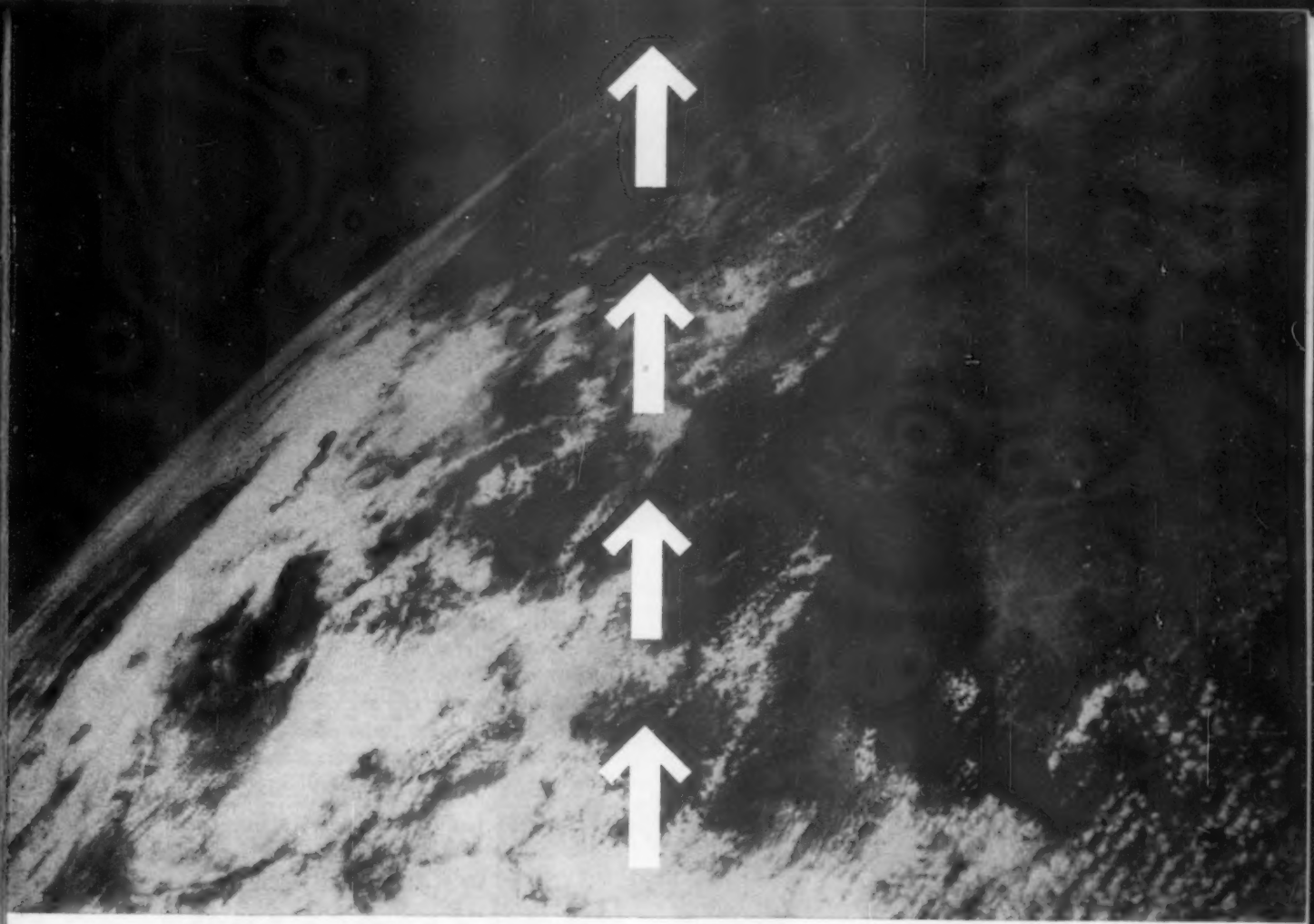
"One other possibility is the employment of the rotor in cruising flight in autorotation. Since the forward thrust is being produced in an economical manner by orthodox propellers, one can allow the rotor to tilt back sufficiently to permit its operating in this manner. By using tip pressure jets, high power can be fed into the rotor for takeoff. Since the jets are in use for takeoff and landing with the rotor under power in this condition only, the drawback of relatively high specific fuel consumption can be tolerated because the advantages to be gained are very great."

Second D. C. Airport Gets New Backing

Washington, D. C.—Necessity has re-activated a drive for a second airport here. Two developments are:

• **Senate Commerce Committee,** in a formal report issued in the closing days of the congressional session, instructed the Secretary of Commerce to request an immediate $3 million appropriation for engineering studies and land.

• **Under Secretary of Commerce for Transportation** Louis Rothschild, declined to push a rush appropriation. But he told AVIATION WEEK that "a



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Shown here is a glimpse of 600,000 square miles of our planet. It was photographed from a Martin Viking research rocket which attained an altitude of 158 miles. This rocket was one of a series developed by a team of Martin engineers and Navy scientists who have worked together since 1946.

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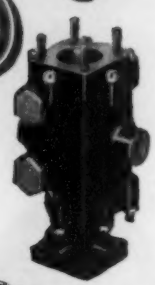

Beyond the blue . . . up to the star-flecked blackness that surrounds the earth . . . and at speeds that leave sound behind! Vital to the jets pioneering these new frontiers of aviation are CECO Engine-Driven Gear Pumps . . . high performance main and emergency fuel pumps for the world's most advanced engines. Whether for turbo-prop or turbo-jet engines, CECO gear pumps assure accurate control of fuel flow for peak power and dependability.

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great big fresh look" is being taken and that "by late fall we should have some very well documented ideas" for the establishment of an alternative for the Washington National Airport.

Meanwhile, Congress approved the total $2.6 million asked by Civil Aeronautics Administration to expand the capacity of Washington National as a temporary measure.

In a report, issued after hearings (AW Aug. 1, p. 21) on the acute need for additional airport facilities, the Senate Commerce Committee ruled out the use of three existing airports to serve commercial air traffic of the nation's capital.

Baltimore's Friendship Airport, the committee maintained, "is so far in driving time from downtown Washington and from the present airport that it cannot provide the best long range solution." Andrews AFB, the committee said, has a military requirement for its full capacity. Use of Bolling-Anacosta airfields was dismissed as being too close to the Washington National air traffic area. "The construction of a new airport for the national capital is imperative and plans for construction should begin immediately," the committee declared.

A project for a second national airport at Burke, Va., approved five years ago by Congress was later killed by the opposition of Virginia and Maryland. Virginia objected to the location of an airport in their vicinity. Maryland interests wanted the Baltimore airport used as an alternative for Washington National. With a $1 million appropriation, Civil Aeronautics Administration purchased land in the Burke area. On the controversial site issue, the Senate Commerce Committee tossed the ball to the Secretary of Commerce, commenting, "It is his responsibility to determine whether to proceed at the site selected near Burke, Va., or to make another selection."

Rothschild has proposed that 50% of the cost of a second national airport be contributed by the federal government and that the remainder be financed by an "authority" of state or local governments, patterned after the New York Port Authority. The authority would operate both Washington National and the new airport.

The Commerce Committee directed the Secretary of Commerce to report to it "on the opening day of the next session of Congress . . . the site selected for development, the stage construction plans, the composition of the authority, if any, he recommends to finance and operate the airports and the amount he proposes to request in the first deficiency appropriation for 1956 to complete the land acquisition and to proceed with the engineering survey and initial development."

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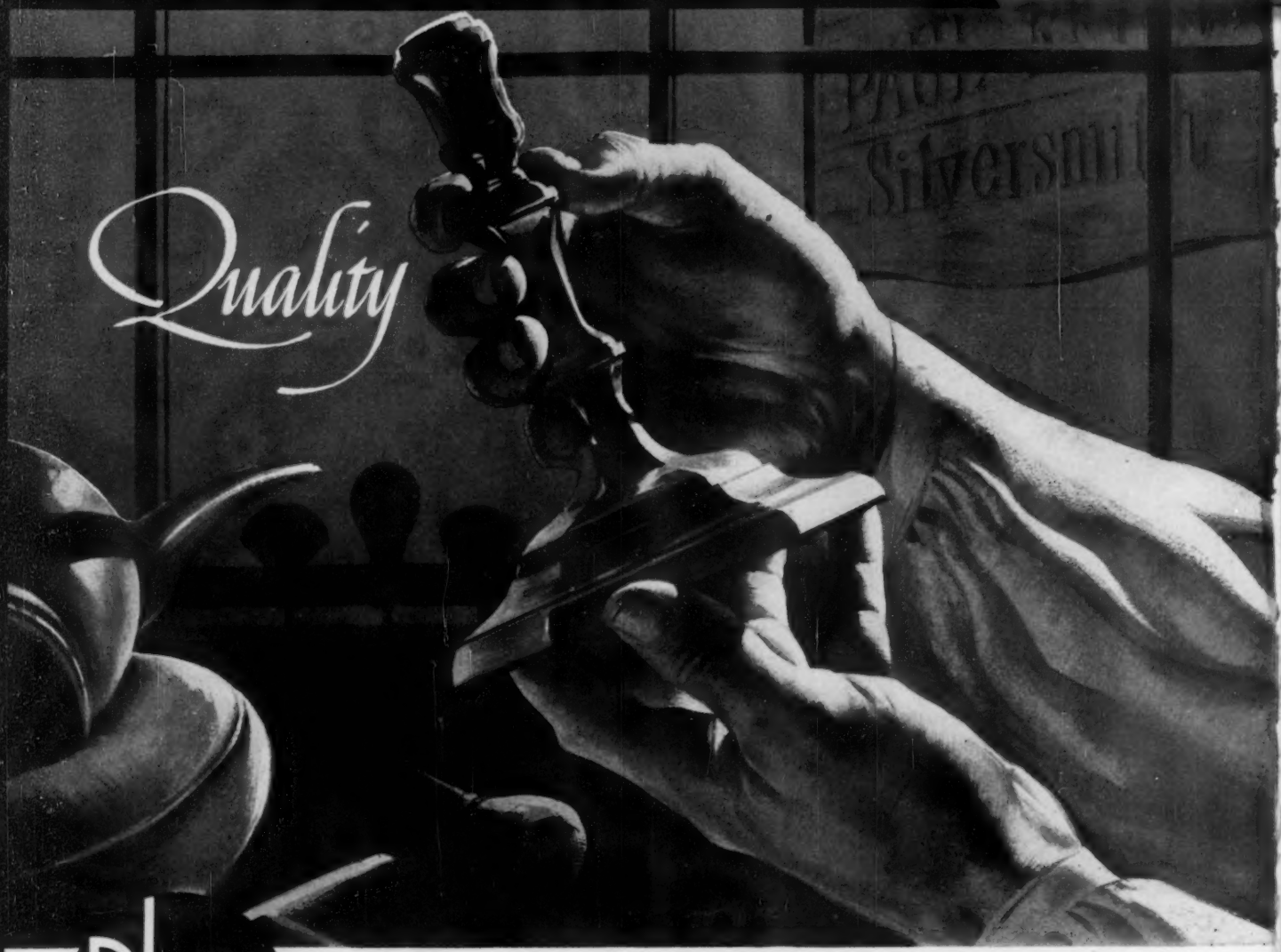

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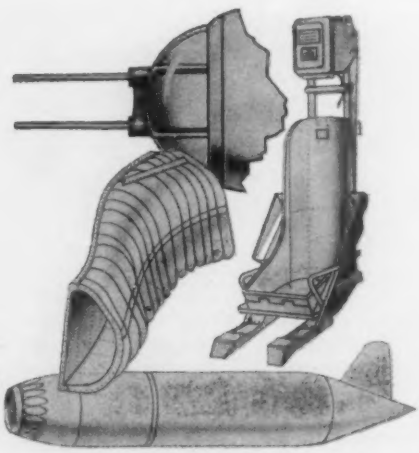

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Russians Look Into Aeronautical Future

Russia's next generation of fighters, with planned speeds approximating Mach 2, will feature long, thin fuselages, straight wings and turbojet power, according to a three-way look at tomorrow prepared for the Russian publication, Literary Gazette, and published just before the recent Tushino displays.

Interviewed for the magazine were Prof. I. Ostoslavsky, "an honored figure in science and technology;" V. Myasishchev, designer and professor, whose name has been linked with bomber development and who may be a protege of bomber designer Andrei Tupolev, and Col. M. Gallai, test pilot and candidate for the degree of doctor of technical sciences.

Other highlights of the interviews included official announcements of:

- **Russian jet transport routes** from Moscow to Irkutsk, Siberia, which are operated by Aeroflot, and carry mail and cargo.
- **Russian efforts to solve the problems of sonic flight** by using "special" wind tunnels and high speed flying models.
- **Russian pure-jet VTOL designs,** one of which is said to have flown.
- **Russian slap at grounded aircraft** in foreign countries.

Literary Gazette, like other Russian publications, may be considered an official voice of the government. This interview and a similar article last year by Artem Mikoyan, co-designer of the MiG (AW Sept. 20, 1954, p. 30), obviously were intended to set the scene for the subsequent air display.

The complete article follows:

Heat 'Barrier'

At various stages in the history of aviation there have been different conceptions of what constitutes high speed. Everyone recalls that before World War II an airplane which developed a speed of 700 kilometers per hour (435 mph.) was a record breaker. Today speeds of 900-950 kilometers per hour (560 to 590 mph.) and the widespread use of jet engines, which have supplanted piston engines, no longer surprise anyone. But the high-powered and comparatively light jet engines which we now possess cannot alone solve all the complex questions that have arisen in the struggle for speed.

"Many people probably have heard about the sonic 'barrier'," Professor Ostoslavsky said to our reporter. "Several years ago someone earnestly asserted that the sonic 'barrier' is a physical, technical, natural and God knows what else limitation on speed. Actually, until the speed of airplanes approached close to the speed of sound —1,200 to 1,250 kilometers per hour— everything went along quite smoothly. However, at this boundary (and even a little sooner) a number of difficulties arose, the greatest danger being the temporary loss of controllability and stability of the aircraft in flight.

"A tenacious search began and, at last, a solution to the problem was found. Success was achieved first of all by building planes with improved jet engines and new sweptback wings of thin profile.

"To find the right answers, we had to do a great deal of experimenting in special wind tunnels, work out a method of testing high speed flying models and build the the most complex measuring and recording apparatus."

Continuing on this theme, Designer V. Myasishchev declared that overcoming the so-called sonic "barrier" once more proved convincingly that this boundary existed more in our perception than in actual fact. It was only necessary to widen the area of exact knowledge of the theory and practice of high speed flight to bring the supposed barrier tumbling down.

"The complex and, at times, tragic struggle to surmount the sonic 'barrier' made our aviation personnel wiser and more expert. Now we are approaching a new 'barrier'—heat this time—but we face it with considerably more calmness and confidence.

"It is known that a body which flies at a speed of 1,000 kilometers per hour

RARE VIEW OF TOP SOVIET BRASS shows Chief Marshal of Aviation Zhigarev speaking during Aviation Day ceremonies at Tushino Airport. At his right is Defense Minister Zhukov; at his left is Chief of Staff of Soviet Armed Forces, Marshal Vassily Sokolovsky.

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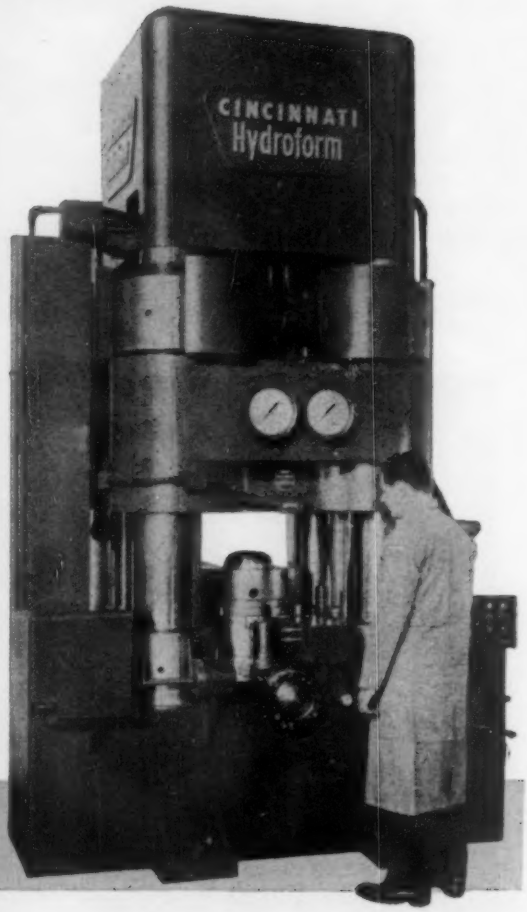

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(621 mph.) is heated 38 degrees Centigrade by friction with the air. But if the speed of flight attains 2,000 kilometers per hour (1,242 mph.) this temperature rises to 150C.

"Between the increase in speed and temperature there exists not a straight-line but a squared relationship. This means that in the future the heating of aircraft will become so great that, let us say, a material as widely used in aircraft as dural becomes entirely unsatisfactory. New alloys must be sought."

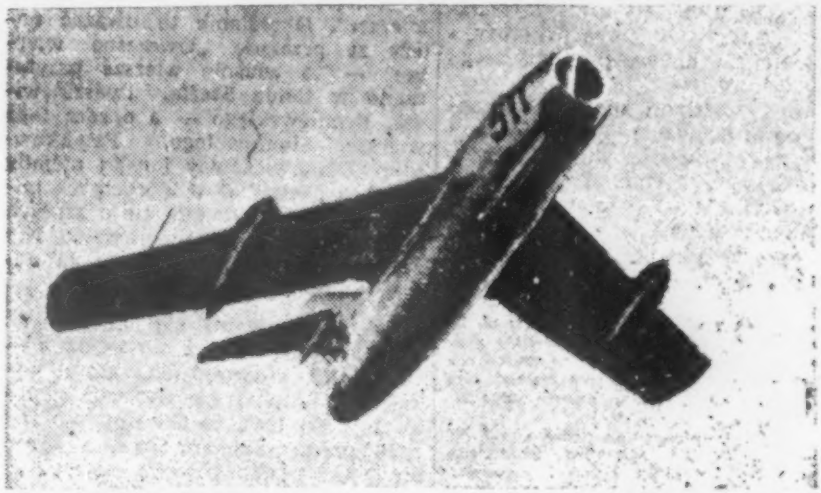
But how will a human being feel during a flight that is even difficult for metal to withstand? Test Pilot M. Gallai recalls that a similar question was raised every time aviation survived a major qualitative leap in its headlong development. It was like this, in particular, when the first jet airplanes appeared.

Many erroneous notions were circulated about these machines. For example, there was a widespread opinion that handling of jets was so extraordinarily difficult that they could be piloted only by flyers with exceptional physical and mental qualities. The very first jet plane flight showed the complete fallacy of these rumors. It is true that a jet plane requires the pilot to do everything quicker and demands higher technical training on his part. But at the same time, piloting is made easier in many ways. This has come about thanks to the better visibility from the plane, reduced noise and vibration in the cockpit and also the increased stability of jet planes as compared with propeller-driven types.

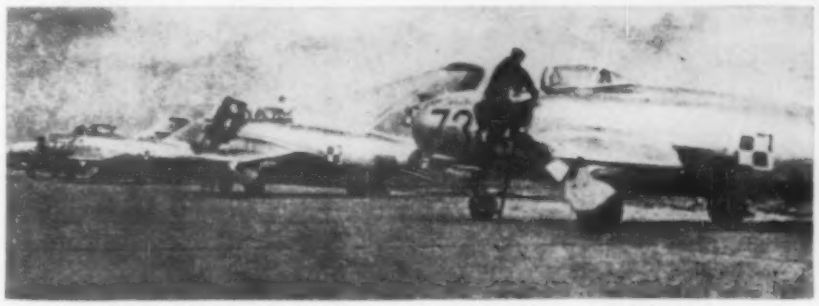
"After overcoming the 'childhood diseases' inherent in all technical innovations, the jet plane quickly lost its exotic flavor," M. Gallai asserted. "Whereas military flyers at first divided airplanes into two groups—conventional (propeller-driven) and jet—they now consider jets as conventional.

"Long experience in the operation of jets has convincingly confirmed that they are highly reliable aircraft and provides a solid basis for believing that even with greatly increased speeds, pilot strain will not become a 'stumbling block in future aviation advances.

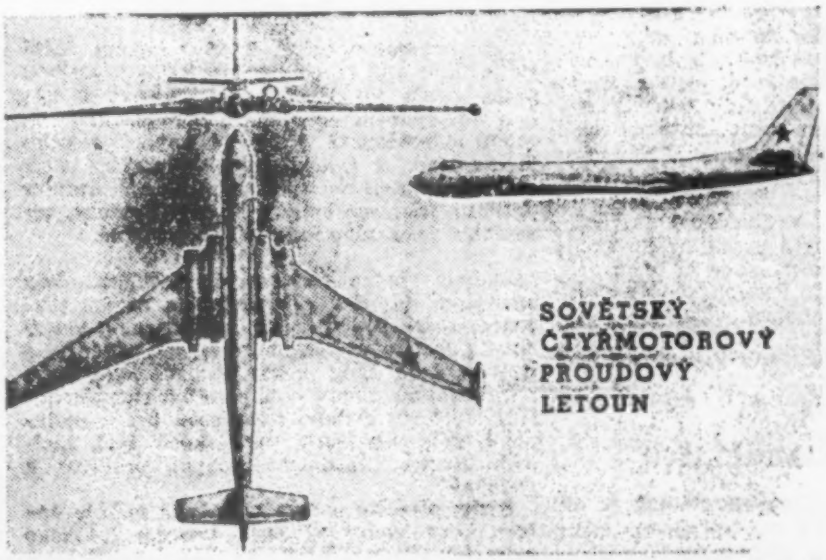
"We won't look too far into the future, since that's considerably more difficult now than in the days of Jules Verne. Practical development of science and technology has at times outstripped the most daring imagination. Therefore, we'll look ahead only a year or two."



FIRST POLISH-PRODUCED MIG took to the air early this year. It will join . . .



RUSSIAN-MADE SISTER SHIPS shown here in service with the Polish Air Force.



BISON THREE-VIEW in Czech paper agrees closely with U. S. Navy recognition model (AW Aug. 8, p. 16). Nova Svoboda calls Bison "Ilyushin's contribution to defense of peace."

New Speeds

"I think," said Prof. Ostoslavsky, "that during the next few years flying speeds on the order of 2,000 kilometers per hour (1,242 mph.) will be attained with turbojet engines used in conjunction with thin shapes and straight wings."

The scientist noted that, in referring to the return of straight wings, he was not disputing the special and valuable role that sweptback wings played in overcoming the sonic "barrier." Why, then, a return to straight wings?

"It has turned out that the new and significant growth in power permits aircraft, in common parlance, to 'slip through' the dangerous sonic speed

G-E TOTALLY ENCLOSED MOTOR FOR GUIDED-MISSILE WARHEAD FUZES, rated .0024 hp, 4500 rpm, 24 volts d-c for intermittent duty is discussed by (l to r) Dr. W. W. Eaton, Industrial Consultant, Dr. C. A. Crowley, Director of Engineering and Development Division, Given Manufacturing Company, and E. Finkle, Given's Chief Project Engineer, Engineering and Development Division.

G.E. adapts motor for missile warhead fuzes, helps Given Company meet deadline, cut costs

"When our Company was selected by the Picatinny Arsenal for pilot production of fuzes for guided-missile warheads," says Dr. C. A. Crowley (center), Director of Engineering and Development, Given Manufacturing Company, "we were confronted with a design that called for a specially built motor to be used for the fuze gear train. Because of previous satisfaction, our first step was to consult General Electric.

"G-E engineers, working in co-operation with our own engineers, were successful in redesigning an existing G-E armament motor to our exact needs. This action not only helped us cut costs, but put us in production on schedule. We're sold on service like this," concludes Dr. Crowley.

As a component of these guided-missile warhead fuzes, the G-E motor is exposed to extremes of temperature from −65 to +160F, and must stand severe vibrations and high humidity. As a part of G.E.'s development work, these conditions were simulated by G-E testing facilities, and the motor passed all tests.

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zone quite freely without sustaining temporary loss of stability and controllability. When the speed reaches 2,000 to 3,000 kilometers per hour the wing sweepback loses its effect.

"Aerodynamics is a capricious science—under various flight conditions its laws are not the same. I dare say that in no other branch of the exact sciences does the constant interaction of theoretical calculation and experimentation play such a decisive part."

Foreign Achievements

Giving due credit to the successes of world science in providing the aviation industry with new knowledge, Designer V. Myasishchev dwelt briefly on technical achievements of foreign countries.

"There have been many new and varied aircraft of high quality," he said. "But at the same time, a new term—strange to our ears—has appeared in the foreign press: 'grounded aircraft.' Here, strange as it may seem, they are talking not about a plane which has made a landing but about the newest-type machines, which have been taken out of quantity production and put on the shelf—'grounded.'

"Mass operation of these aircraft showed they had a whole series of defects. This testifies to the fact that in our times the struggle for speed is a complex and delicate matter and not a simple, mechanical accretion of power. Failures overtake even the best engineers who have rich experience in aircraft construction."

Men who test new aircraft always live "in the tomorrow." As far as mastery of new technique is concerned they outstrip the flyers in line units. Taking this into consideration it was interesting to find out what tendencies in aviation development seem most important to M. Gallai.

"If not the most significant, at least the most noticeable technical trend for pilots," M. Gallai declared, "is the steady increase in new instruments and equipment in aircraft. Already there are so many instruments and other items of equipment in the cockpit that the pilot hardly has the time and attention capaciy to handle them. But the 'invasion' of aircraft by newer and newer technical gadgets continues.

"It is impossible, as well as undesirable, to stop the torrent since every new instrument improves the aircraft in some way and increases its capabilities. Only one solution remains—broader introduction of automatic equipment which will take over more and more functions connected with communications, navigation, engine checking and even the guiding of the plane."

At the same time M. Gallai emphasized that he doesn't go along with those who hold the theory that the profession of pilot is a dying one that will be replaced by some sort of universal automaton. "Every type of pilotless aircraft only complements piloted aviation and in no way replaces it. Automation cannot supplant the live pilot—the bearer of creative human intelligence. It can only lighten his work. Of course, this means that the human pilot requires the highest technical training if he is to make the best use of all his automatic equipment."

Reality and Proposals

At first an almost imperceptible growth in the size of airports took place with the new development of jet aviation. Now this growth has attained menacing proportions: runways have become too big, too expensive to build and, most important, absolutely stationary.

What now? How can modern aviation be made less dependent on runway conditions? Our scientists, designers and aviation commanders are busy with this question.

The classic airportless flying machine is the helicopter. Actually it doesn't need an airport and it has many undeniable advantages. It is the only aircraft able to stop in midair and go backward. But the speed, ceiling, and load-carrying capacities of helicopters are considerably less than for conventional aircraft.

Prof. Ostoslavsky declared: "It's no longer a curiosity when engines with a total of 50,000 hp. are put in an airplane. However, when the pilot reduces power in landing, this enormous force slumbers, figuratively speaking. If the power is forced to work to the fullest it is possible to endow the airplane with the best qualities of the helicopter.

VTOL Techniques

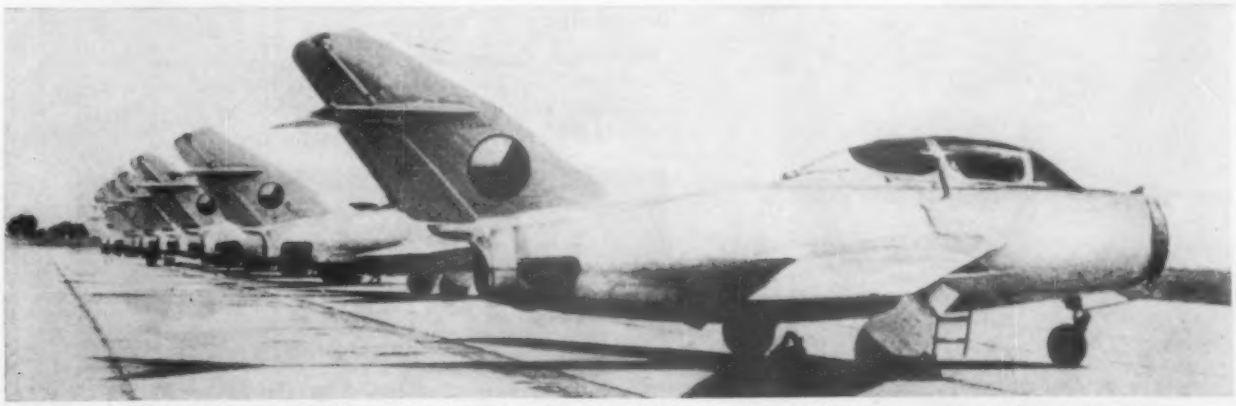
"Here is one of the principal variations of the proposed solution to the jet-age landing field problem. If on takeoff the stream of gases is directed straight down it is able to take the place of the wings' lifting power. This permits the plane to take off with almost no runway. In landing the same jet of gases takes upon itself a large part of the aircraft's weight. This permits landings at much lower speeds. The first models of such machines already have appeared. They take off and land almost vertically.

"Yes, takeoff of fast jet planes from one spot is already reality! One must think of the day not far off when speedy airportless machines are in wide use and when starts from limited areas—perhaps even inside cities—will become as ordinary an event as a takeoff from Vnukovo Airdrome."

In concluding the interview, V. Myasishchev shared his ideas regarding the trend of development in transport.

"We will try to imagine how the Moscow-Peking route will look a few years hence. A powerful passenger plane equipped with turbojet engines and advanced devices rises from a small takeoff strip at Moscow airport. It will be able to fly to its destination in any kind of weather.

"The 100 to 120 passengers aboard spend only eight hours in the comfortable cabin before alighting in Peking. En route they will experience no



CZECH AIR FORCE MARKINGS distinguish these Russian-built MiG fighters lined up at air base somewhere in Czechoslovakia.

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Switching to Flash Butt-Welding of Mill-Rolled Sections, Slashed Production Cost 76½%

NEW METHOD

Ring, rolled and welded from mill section of approximate shape of finished part.

OLD METHOD

Ring, rolled and welded from rectangular bar size to maximum overall dimensions of finished part.

Rough rings purchased by a well known manufacturer of jet aircraft engines weighed 135 pounds each. Most of this weight was excess metal which had to be machined away. American Welding's Industrial Products Division, working with this company, studied blueprints and recommended a flash butt-welded ring, formed from a special mill-rolled section. Adopting this new ring saved 88 pounds of metal and eliminated much of the machining time required. American Welding now produces thousands of these rings, in a rough-machined state, at less than one-quarter of the original cost.

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trace of motion sickness since the plane will fly higher than the very limit of the troposphere and above all meteorological disturbances. The plane will have a hermetically sealed cabin to maintain normal atmospheric pressure in flight and will have an artificial climate that is comfortable in both summer and winter. Perfected sound insulation will entirely eliminate annoying noises which are inevitably present with powerful engines.

"But haven't we rushed too far ahead? Haven't we torn ourselves away from the real possibilities of the immediate future?

"One little detail convinces us that the picture we have clearly sketched has a completely practical basis. Air passengers are already making the Moscow to Peking journey. By jet transport the trip will cost half as much as by Pullman.

"If you add to this detail one more important fact—Aeroflot (Russia's civil airline monopoly) is already operating the first jet plane flights from Moscow to Irkutsk, temporarily carrying only mail and cargo—then no doubt remains that in the near future we will actually be able to breakfast in Moscow and eat supper in Peking the same day."

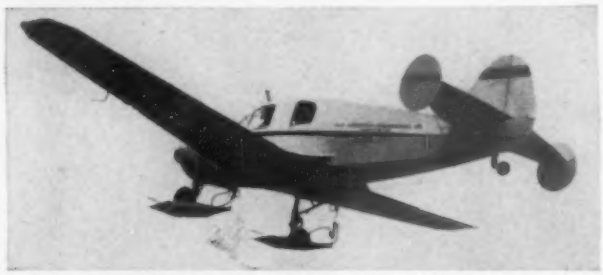
MATS' YC-131Cs Log Time Fast

The two YC-131C turboprop transports of the Military Air Transport Service have logged a total of more than 1,200 flight hours, including 1,000 hr. since their delivery in January to MATS' 1700th Test Squadron (Turboprop), Kelly AFB, Tex.

As the squadron has gained experience with the Allison YT56-A3 turboprop engines, daily utilization of the two Convairs has gone up. Utilization factor during June was 7.9 hr. a day, including days when flying time exceeded 15 hr. On a routine scheduling, one of the ships was flown more than 44 hr. over a three-day period.

The turboprop test squadron's primary mission is to give the planes the maximum hours in the minimum time in order to gain turboprop engine operating data. The information will be made available to the air transport industry.

Retractable Hydro-Lift Gear Passes Flight Test



These first pictures show All American Engineering Co.'s Bellanca Cruisemaster fitted with retractable hydro-lift landing gear. The ski-like attachments on the plane, which has made several flights with the retractable gear, permit it to land or take off from nearly any surface, including snow, mud or water.

The plane's main wheels protrude through the ski far enough (above left) to allow it to operate conventionally from airports and fields, and to taxi up onto a beach after a water landing. Skis are shown retracted in the photo immediately above. Closeup below shows Bellanca taking off from water.

Other hydro-lift installations have been made on a Piper Cub and Cessna OE-1, but this is the first retractable installation—a step towards the development of hydro-lift for high-performance aircraft.

The Wilmington, Del., firm says the new gear costs the Bellanca only two knots in airspeed and weighs less than 100 lb.

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PRODUCTION BRIEFING

▶ **Boeing Airplane Co.,** has moved its general procurement, outside production and traffic units to a new location on Ellis Ave. and Warsaw St., Seattle, Wash.

▶ **Aro Equipment Co.,** Bryan, Ohio, has purchased the Ampatco Laboratories Corp., manufacturers of electro-mechanical precision instruments. Ampatco will operate as a separate corporation in Aro's Cleveland plant.

▶ **Metal and Thermit Corp.,** Rahway, N. J., has begun a $2 million expansion project to be completed about April, 1956. Plans call for a general office building, a distribution warehouse and a central steam plant on the company's 17-acre tract on Rahway Ave.

▶ **Ford Motor Co.'s Aircraft Engine Division** has received its first shipment of a new packaging desiccant and static dehumidifier to be used in packaging of J57 jet engines. Manufactured by Culligan Co., San Bernadino, Calif., Humi-Sorb is placed in hermetically sealed containers with the engines.

▶ **Hachmeister-Inc.,** Pittsburgh, Pa., maker of industrial chemicals, has opened a new warehouse at 812 Delaware Ave., Philadelphia, to handle shipments formerly operating out of its Baltimore warehouse, which closed on July 1.

▶ **Ideal-Aerosmith Inc., Hawthorne,** Calif., has engaged Tubergen Associates, Los Angeles, as sales representatives. Tubergen will represent the precision instrument maker in southwestern part of the U. S.

▶ **Atomic Instrument Co.,** 84 Massachusetts Ave., Cambridge, Mass., supplier of nuclear energy measuring devices to the aircraft industry reported that orders for the first six months of 1955 totaled more than $622,000, a 35% increase over the first six months of 1954. Total shipments for the first half of 1955 was more than $523,000, a 21% gain over the similar period last year.

▶ **Luria-Cournand, Inc.,** Havre de Grace, Md., structural plastic fabricators, has delivered 412 Plexiglas side panels to Glenn L. Martin Co. for RB-57B canopies.

▶ **McDonnell Aircraft Corp.,** St. Louis, has awarded follow-on contracts totaling $542,375 to McLean Development Laboratories, Inc., Copiague, L. I., N. Y., for fabrication of bomb racks for F2H Banshee fighters.

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BUDDY REFUELING OPERATION as visualized by artist. Stripped of refueling pod, tanker can act as fighter on shorter missions.

Air Force-Navy Testing "Buddy System"

By Irving Stone

Los Angeles—The Air Force and Navy have begun evaluation tests of an inflight "buddy system" refueling plan designed to give carrier and advance-base fighters a prolonged combat radius and power enough to deliver a knockout blow deep within the enemy heartland.

The necessary engineering for the previously-announced plan (AW Mar. 14, p. 88), whereby one fighter acts as a high-speed tanker for a sister ship has been completed by the Schulz Tool and Mfg. Co., of San Gabriel, Calif., and actual flight tests of the design are expected by the end of the year.

Under the "buddy system," the Navy would divide a 36-plane group into 18 tankers and 18 combat aircraft on long-range strikes that demand inflight refueling. On shorter missions—and stripped of its refueling packages—the fighter-tanker could serve in its normal combat capacity.

Both the Air Force and Navy could rely upon the fighter-tanker in areas where it might be dangerous to employ the slower, more vulnerable, standard tankers. Under present plans, the fighter-tankers would carry just enough ammunition for self protection.

Either one or two refueling packages could be carried by the fighter-tanker, depending upon the amount of fuel required by the receiver and the number of receivers involved. It also is conceivable that two fighter-tankers could be used to extend the air time of a single fighter on protracted flights.

The package Schulz is building consists of a modified 450-gal. standard drop tank so that both refueling gear and fuel can be accommodated. The refueling gear takes up 150 gal. of fuel space, leaving room for 300 gal. of transferrable fuel.

As a refinement, Schulz has proposed that, when needed and feasible, additional fuel from other tanks in the tanker be transferred to the package tank and then the receiver aircraft.

High Speed Transfer

The gear has been designed to operate at speeds of up to 400 knots at sea level, at altitudes up to 50,000 ft. and at temperatures below −65F. Dry weight of the complete refueling package is 462 lb. Carrying 300 gal. of fuel and the refueling gear, the package weighs less than a similar drop tank loaded to capacity.

The refueling gear consists of a set of folding tubes which are extended into the air stream for the refueling job. The tubes connected to the tank project downward to give the required clearance between the aircraft. Connected to this pair of tubes by a flexible joint is another tube which trails aft horizontally. The trailing tube carries a standard Type MA-2 reception coupling and a 20-in. cone which the receiver engages with a Type MA-2 nozzle (probe).

Upon engagement, refueling starts automatically. Fuel is transferred at the rate of 300 gpm. (with a possible potential of 600 gpm.) by pumps or by jet engine bleed air pressure to the refueling package.

If the receiver pilot maneuvers out of position during refueling—either forward, up, down, right or left—limit

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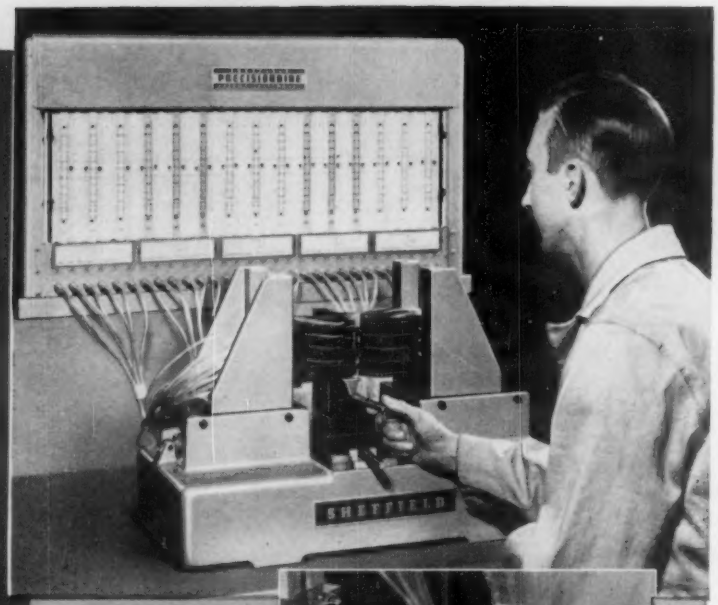
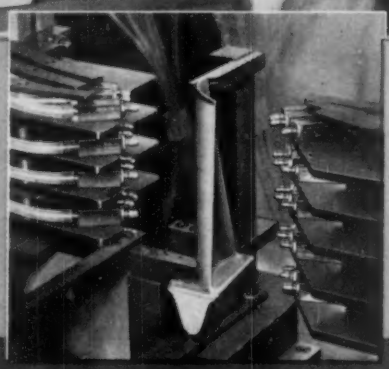


Checking 30 points on a jet engine blade



Gaging heads ready to approach the jet engine blade

Spectacular developments in AIR gaging are saving industry millions of dollars and thousands of man-hours. Here's how and why:

1. One operator with one gage can check up to 40 or more dimensions of each work part simultaneously and instantly. The number of parts per hour depends solely on how fast the inspector can handle them.

2. Precision is built into the gage—readings are unaffected by human skill, human judgment and human memory. It's not necessary to memorize and compare readings for individual dimensions—one quick panoramic glance at the float pattern ("Airechart") tells the whole story—the "Float Graph" shows the true condition of every critical dimension.

3. The position of each float shows just where the dimension is within tolerance limits or just how much above or below limit if it is out of tolerance. This is essential for Quality Control.

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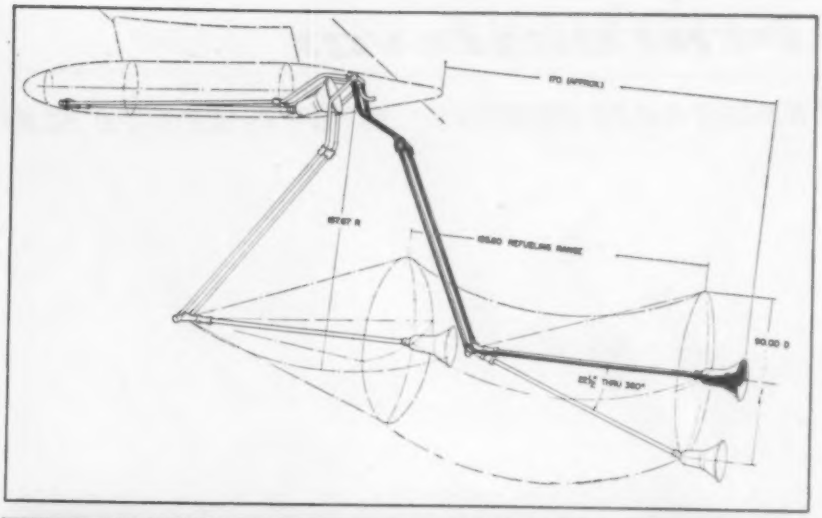

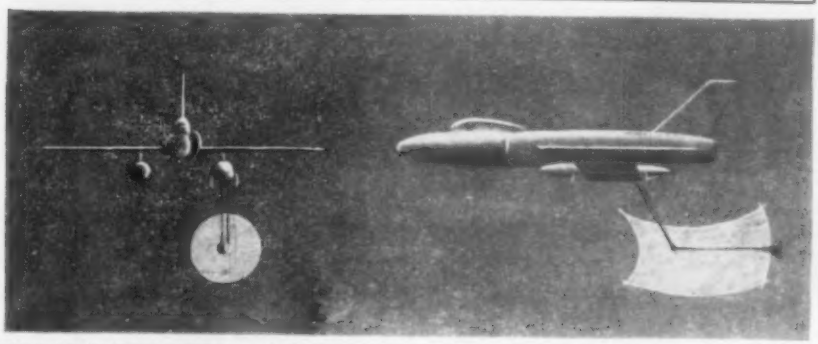

SCHULZ BUDDY SYSTEM refueling package schematic shows gear in folded and extended positions. Dash-dot lines, corresponding to light areas in artist's rendition, indicate range of movement. Switches break connection when limit is exceeded.

switches break connection with the receiver and the refueling tubes are automatically retracted. A warning light notifies the tanker pilot of a break and he can re-extend the tubes for another engagement. Extension or retraction requires 2 to 3 hp. The power source may be electrical or hydraulic.

Tiptank Refueling

The refueling package need not necessarily be an underwing drop tank. A tiptank package could be designed with refueling tubes capable of extending downward, to the side or even upwards.

Schulz also has designed refueling gear to fit into a 100-gal. tank with facilities for transferring additional fuel from the tanker's main tanks. Proposal for this type of installation already has been made to one airframe manufacturer.

Schulz, whose production has been primarily concerned with fuel system components for aircraft, began operations in 1945. Its products now include fuel system valves for such service as fuel level control for ground and flight refueling, air pressure transfer, air pressure and vacuum relief, tank venting, solenoid-operated shutoffs and check valves. Except for check valves, none of these units are "off-the-shelf" items.

Schulz valves such as these are installed on the F-101, F-102, F-104, F-105, B-58, B-52, KC-135, KC-97, C-130, P2V, T2V and various other aircraft.

Sensitive Meters Probe Stratosphere

Air Research and Development Command scientists are employing high-altitude electronic sensing units to probe and record electrical charges in the stratosphere at 60,000 and 100,000-foot levels.

Flights of special electronic field strength meters are providing measurements of electrical charges set up by thunderstorms and the nature of the electricity constantly flowing from sky to earth. Information on the composition of the atmosphere, variation of ozone with altitude, concentration of carbon dioxide and effect of infrared and ultraviolet light also is being obtained from the experiment.

The meters, designed by Minneapolis-Honeywell, are capable of measuring electric current as low as one-quadrillionth of an ampere. The size of a portable radio and weighing 14 lb., the meters are sent aloft from the Orlando, Fla., Air Force Base attached to huge plastic balloons.

When in flight, the instruments hang 500 ft. below the balloons, pick up electrical measurement and simultaneously radios findings back to a ground recording station.

The project is being carried on under the direction of Geophysics Directorate of the Cambridge Air Research Center and will be concluded in September.

Committee Asks Study Of Subcontract Policy

Senate Small Business Committee proposes that a prime contractor's policy on subcontracting to small businesses be a key factor in the award of major defense contracts.

In a report to the Senate, the committee stated that it "recommends that the Army, Navy and Air Force adopt the element of subcontracting as one of the most important criteria in determining which contractor will receive the award under the negotiated method of contracting."

The Committee also proposed:

- **That the secretaries of the three services** "take a personal hand" in implementing programs to spread defense business among small contractors.
- **That representatives** of the Small Business Administration be given authority to screen all classified procurements "in the interest of further stimulating the small business program."
- **That the three services** initiate "a detailed reappraisal" of items which are now considered to be outside the area of accomplishment by small firms. "The committee has found that many times in considering the production of complex and technical items, the ability of small business is grossly underestimated," the report noted.
- **That more contracts** be awarded on an advertised bid basis, less on a negotiated basis. "The committee still feels that there is an indiscriminate use of the power of negotiation by the military departments."
- **That assistant secretary of defense** for supply and legistics, Thomas Pike, "immediately" appoint a board composed of procurement and small business representatives of the three services and a representative of the Small Business Administration to act as a "watchdog" over the small business aspect of defense procurement. It was urged that the board review all key defense items "to determine which items cannot be produced by small firms, which definitely can be produced by small firms, and which items are in the doubtful or questionable category."

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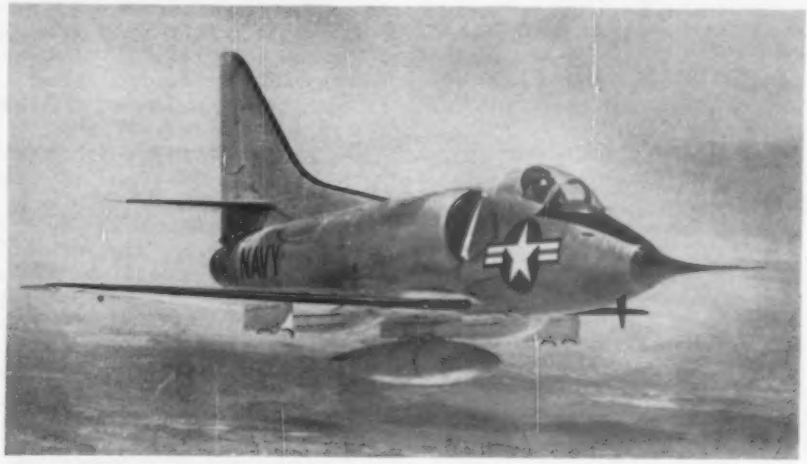
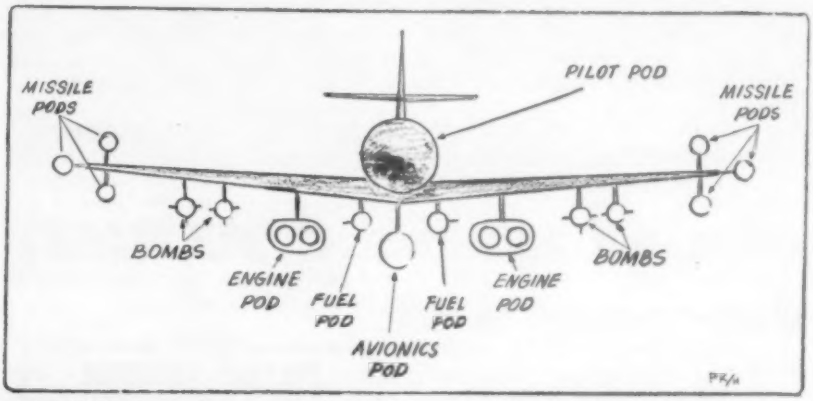


DETACHABLE FUEL TANK on A4D indicates possible trend in fighter design, where . . .



BASIC AIRFRAME serves as vehicle for avionic, engine, fuel, bomb, missile pods.

Avionic Pods Could Make Fighter Jack of Many Tactical Trades

By Philip J. Klass

Avionic equipment mounted in quickly-detachable external pods slung from the belly or wings of fighters may make it possible within the near future to convert such planes into navigational bombers, radar search planes or photographic ships almost at will and as the tactical situation demands.

Through the use of the proposed pods, the Douglas A4D or new Lockheed F-104, for example, could be designed to accept any one of a number of external pods, with each changing or expanding the aircraft's primary assignment. A paper on the advantages of pod-mounted avionics, delivered at the recent Dayton avionics convention by H. A. Brelsford, of the Radio Corporation of America, suggested that RCA may be packaging some of its new fire-control equipment in such pods.

The pods, once significant and varied production is begun, could contain:

- **Surveillance radar** for daytime aerial combat.
- **Tactical navigation-bombing system.**
- **Interceptor fire control system** for all-weather operations.
- **Infrared** or other ground surveillance devices.
- **Electronic countermeasures equipment.**
- **Aerial camera** and associated avionic controls.
- **Target drone guidance equipment.**

If there were several tactical navigation-bombing systems, there would be a corresponding avionic pod designed to work with each. Basic communications and navigation equipment required at all times (UHF, Tacan, etc.) for all types of missions probably would be installed within the airframe as at present.

The idea of pod-mounting avionic equipment is not new. However, the growing trend of employing fighter airframes for a variety of tactical tasks—in part due to the development of baby A-bombs—has re-focused attention on the plan.

The same approach is being explored in the "buddy system" of extending the range or combat time of fighters by in-flight refueling (see story on page 53).

Advantages of Pod Mounting

Pod-mounted avionics, aside from its conversion possibilities, offers many other potential advantages:

- **Simplified maintenance.** In the event of a malfunction, the entire pod can be removed and replaced with a new unit in a matter of minutes. The faulty pod, including all its interconnecting cables where troubles frequently develop, can be returned to a well-equipped maintenance shop for trouble-shooting.
- **Airplane growth potential.** When a new airframe is under design, it usually is impossible to anticipate all the tactical roles the plane may be called upon to perform. As new tactical roles develop, it becomes extremely difficult, and sometimes impossible, to shoe-horn the required new avionics equipment into the jam-packed fuselage.

With pod-mounted avionics, however, a new tactical role would merely involve switching to a new pod, plus possibly the addition of a new cockpit instrument display and an operating panel.

- **Easier logistics.** Much avionic equipment for tactical use, such as fire control and bombing systems, have their black boxes tailored to an individual airframe configuration because of tight space limitations. A fire control system for the F-102, for example, will not fit into an F-104 and vice versa. This poses serious military logistics problems.

By going to pod mounting, a single design can be used on a variety of aircraft types. In addition, since an airplane carries only the avionic pod required for its mission of the day, unused pods containing other types of equipment can be assigned to other aircraft. This shuffling of equipment between aircraft should reduce the number of each type required by the military.

- **Simplified set-up.** For those types of avionic equipment that require special preflight calibration or programming, pod-mounting permits the operations to be performed without tieing up the airplane.
- **Fast riddance.** In any combat emergency, the avionics pod could be jet-

tisoned to give the plane increased speed.

Industry Benefits

There are equally attractive advantages for both the aircraft and avionics industry:

• **Aircraft design eased.** Airframe and avionics development usually proceed at a parallel pace. This makes it difficult for the aircraft designer to get exact dimensions and weights of the many black boxes he must locate within the airframe.

Other unknowns during the early phases of airframe design include the number of interconnecting wires between black boxes, which of these are critical insofar as stray pick-up is concerned and the amount of cooling capacity necessary to dissipate avionic heat. These unknowns can delay the freezing of airplane design and result in poor internal space utilization within the fuselage. If one or two of the black boxes end up larger than the earlier estimates, the aircraft designer frequently is in serious trouble and may be forced to shift the location of dozens of other units.

With pod-mounted avionics, the airframe designer need only make provisions for supplying electrical power and connections to the pod and locate the basic communications and navigation equipment, whose design is far more standardized than that of tactical equipment. The power might even be generated within the pod itself.

• **Packaged design.** Nothing pleases an avionics manufacturer any more than to be given the responsibility for providing the complete system, including packaging, after he has been supplied with pod dimensions, or "slenderness ratio." This enables avionics designers to work out the most efficient and advantageous arrangement of boxes, sizes, mounting locations and interconnections. It also partially eases the need for close liaison between avionics and airframe designers on such matters as box size, weight, location and cooling requirements.

When the pod leaves the avionics manufacturer, it will have been tested as a complete operating system, and, when it arrives at the airframe manufacturer's plant, it will be easier to check out, handle and install.

• **Easy to Up-Grade.** Pod-mounted avionics simplifies equipment up-grading or modification. New and improved models can be designed without being handcuffed to the dimensions of previous equipment and without extensive modification within the airframe.

Some Disadvantages Too

Pod-mounted avionics has its disadvantages, too. Among them:

• **Increased Drag.** External pods are bound to add some increased drag. This can be held to a minimum, however, by selecting favorable length/diameter ratios for the pod. For example, an avionic pod weighing 700 lb., 14-18 in. in diameter, with a slenderness ratio of 10:1, would slow down a single-engine fighter by about 9 knots at a speed of 360 knots, RCA's Brelsford said.

At very high speeds, where external stores become impractical, pod-mounted avionics might be tucked away in the bomb bay, Brelsford suggested, although this eliminates some of its advantages.

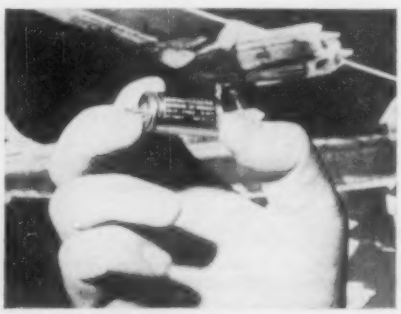
• **Harmonization problems.** For certain types of avionic equipment, such as fire control, the relationship between the radar antenna's line-of-sight and the centerline of the airplane must be known and closely maintained during all flight conditions when the equipment is in use. This might preclude the wing mounting of pods containing such avionic equipment. Flexure of the wing could introduce serious harmonization errors between the airplane centerline and the radar's line of sight. (Shortly after the end of World War II, several manufacturers of bomber defensive armament investigated the possibility of wingtip turrets, directed by radar and/or manually operated gunsights within the bomber fuselage, but harmonization problems resulting from wing flexure led to abandoning the idea.)

However, a carefully designed belly mounting could provide sufficient rigidity between airframe and avionic pod.

Self-Cooled and Powered

To simplify the avionic pod installation on the airframe, the pod should contain its own internal cooling system for dissipating avionic heat, Brelsford believes. This might take any number of forms, depending upon the speed of the plane and other factors. Possibilities that Brelsford cited include:

• **Ram-air heat exchanger,** for aircraft speeds up to approximately 800 mph.



Thumb-Size Motor

With top speed of 19,250 rpm., this motor is believed to be the smallest now used in aircraft, according to General Electric's Instrument Dept., which developed the device. Motor, weighing only 1.2 oz., is used to power a braking mechanism in a GE gyro compass.

• **Expanded ram-air cooling system,** for flight speeds of 500 to 1,400 mph.

• **Flush-skin heat exchangers,** for speeds up to 900 mph.

• **Heat transfer to aircraft fuel** (functioning as a heat sink), useful up to approximately 1,200 mph.

• **Refrigerative type** heat exchangers.

• **Evaporative cooling,** either direct or indirect, useful up to 3,000 mph.

The avionic pod can be supplied with power from the plane's generators. This means, however, that the airframe designer must anticipate the amount and type of power required for a variety of pods that might be used. It also means the plane frequently will be carrying considerable excess power generation capability.

To take full advantage of the flexibility offered by pod-mounted avionics, the pod probably should contain its own built-in power source. This might take the form of a small ram-air turbine driving electrical generator (a.c. and/or d.c.).

To maintain required voltage and frequency regulation over the wide range of aircraft speeds, some type of constant-speed drive might be required in addition to conventional voltage regulation devices.

The many advantages pod-mounted avionics offer the military services, aircraft manufacturers and the avionics industry suggest that this approach will find increasing use, particularly on multi-purpose fighter airframes.

FILTER CENTER

► **Ames 'Brains' Named**—Two new digital computers have been installed at the Ames Aeronautical Lab (AW July 11, p. 15) to speed computations and reduction of wind tunnel data at the NACA's West Coast facility:

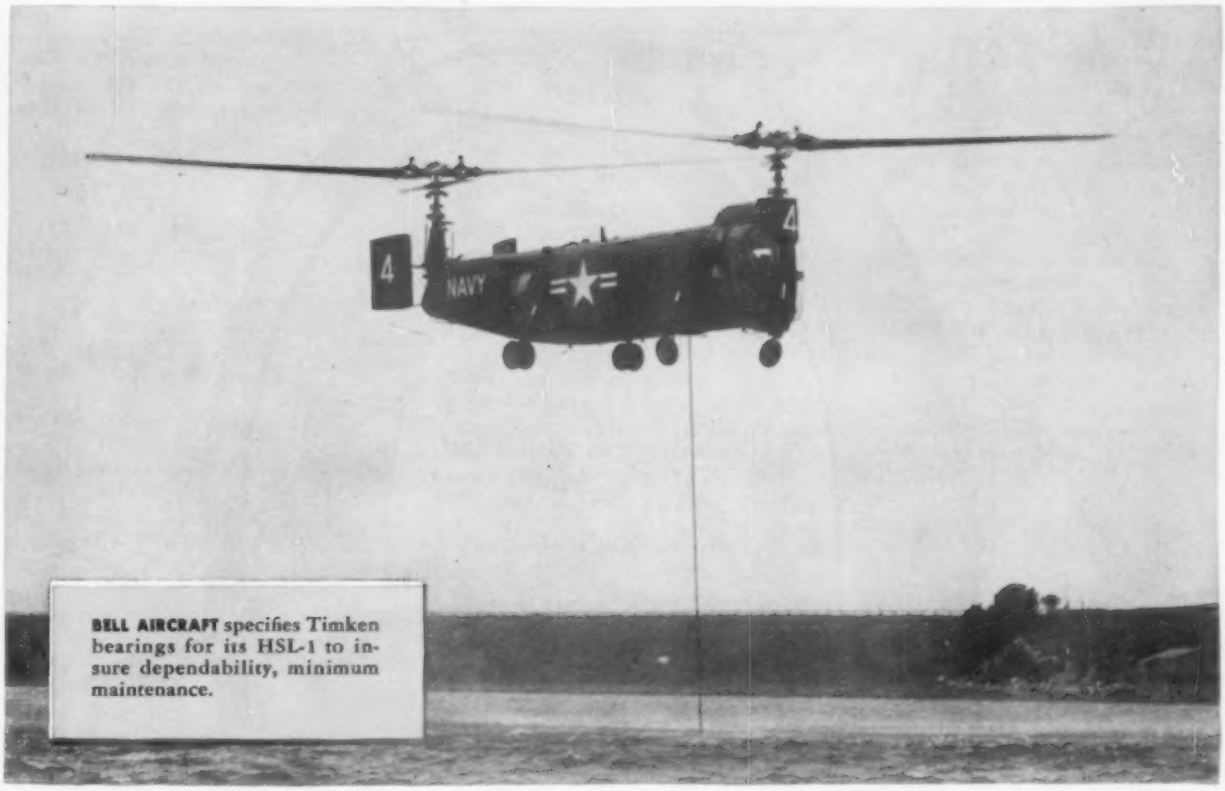
• **Datatron,** product of ElectroData Corp.

• **650 Magnetic Drum Data Processor,** product of International Business Machines Corp.

► **Wanted: Data Handling Papers**—IRE's professional group on instrumentation has scheduled a three-day conference in Atlanta, Ga., Nov. 28-30, on the subject of data handling. Prospective authors may obtain further information from D. L. Finn, School of Electrical Engineering, Georgia Institute of Technology, Atlanta, Ga.

► **New RTCA Reports**—Four recently published reports, prepared by the Radio Technical Commission for Aeronautics on technical studies conducted by its special committees, are now available:

• Minimum performance standards for



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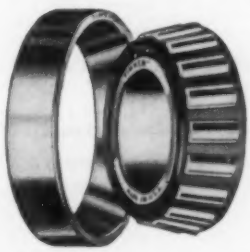
Whether you build or buy aircraft, make sure the bearings have the trade-mark "Timken". No other bearing can give you so many advantages. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

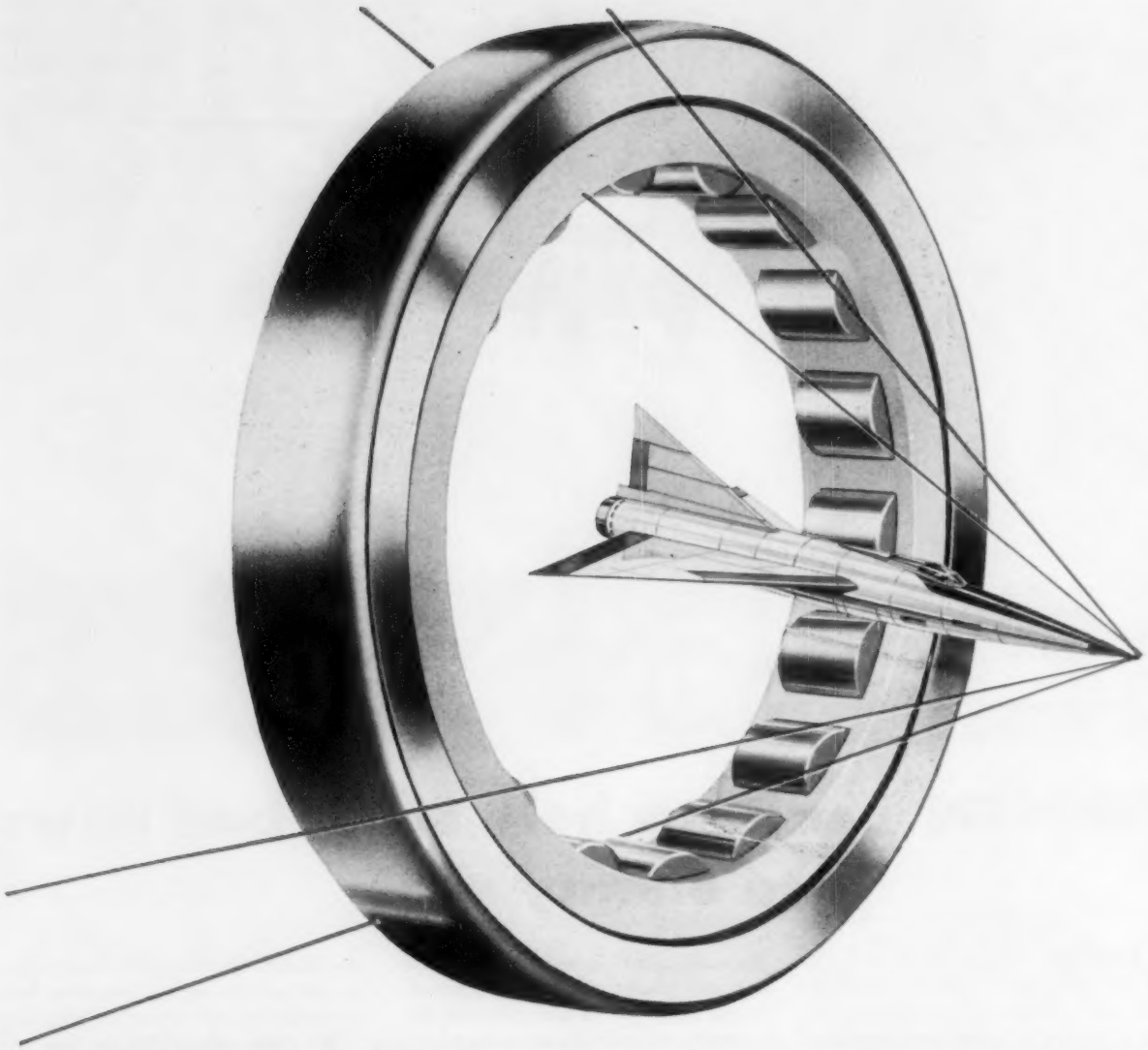


TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

OUR OWN NICKEL-RICH ALLOY STEEL MAKES TIMKEN BEARINGS TOUGHER

Nickel makes steel tougher. And we don't skimp on nickel in the fine alloy steel we make for Timken bearings. Our steel-making specialists use the exact amount to give Timken bearings the toughness they need to withstand shock, last longer. We control the quality of Timken bearings at every step in production—from melt shop through final bearing inspection.

NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL AND THRUST ⊂⊃ LOADS OR ANY COMBINATION



Faced with a formidable "bearing barrier"?

HYATTS CAN HELP BREAK IT!

More speed! More range! More power! is the constant demand—and the jet engine designer's problems seem to multiply like rabbits. Not the least of them is finding bearings that will absorb the punishment of unprecedented heat and rpm's.

That's where HYATT comes in. We may already have the answer for you. If we don't, you can be perfectly sure of this: *nobody* is better qualified—in engineering, experience and facilities—to find the answer in a hurry. Remember, when your design requirements outstrip the capabilities of ordinary bearings, *come to HYATT for help.* Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

STRAIGHT BARREL TAPER

airborne VHF receivers. Paper 87-55/DO-64. Price: 30¢.

• Minimum performance standards for airborne VHF transmitters. Paper 88-55/DO-65. Price: 30¢.

• Re-evaluation of VOR airway lateral separation criteria. Paper 86-55/DO-63. Price: 75¢.

• ILS/VOR/DME frequency channel unitilization. Paper 97-55/DO-66. Price: 65¢.

Copies may be obtained from the RTCA Secretariat, Room 2036, Bldg. T-5, 16th St. & Constitution Ave. N.W., Washington 25, D. C.

► **VOR Airway Separation**—Recent report by RTCA Special Committee 62, following analysis of the accuracy of five makes of VOR receivers, reaffirms the suitability of earlier recommended 15-deg. lateral separation in omnirange radials for passing aircraft. SC-62 tests indicated that four of five makes of VOR receivers are capable of indicating VOR bearings with an accuracy of ± 4 deg. or better with a statistical probability of 95%, providing a 5-deg. buffer zone between passing aircraft with a statistical probability of 99.9%. However, SC-62 recommends:

• **Establishing minimum performance standard** for VOR receivers employed in VOR airways flights under IFR conditions to assure their meeting the ± 4-deg. accuracy.

• **Restricting aircraft equipped with VOR receivers** which do not meet this standard, to operations under VFR conditions only.

Copies of the report, including analysis of VOR receiver tests, may be obtained for 75 cents from RTCA Secretariat, Room 2036, Bldg. T-5, 16th & Constitutional Ave. N. W., Washington 25, D. C. Ask for paper 86-55/DO-63.

► **Handy Printed Tape**—Miniature, finely detailed schematic and wiring diagrams for avionic equipment now can be reproduced on waterproof pressure-sensitive tape. The tape can be placed on the inside of an equipment chassis to simplify trouble-shooting and it is available in widths of up to three inches in a choice of colors. Manufacturer: York Tape Printers, Inc., York, Pa.

► **Navy Secy. to Talk on Automation**—Secretary of the Navy Charles S. Thomas will be a luncheon speaker on the first day of the Electronics and Automatic Production Conference, Aug. 22-23, in San Francisco. Mr. Thomas will speak on "Automatic Production and National Defense." The conference is sponsored by the National Industrial Conference Board and Stanford Research Institute.

NEW AVIONIC PRODUCTS

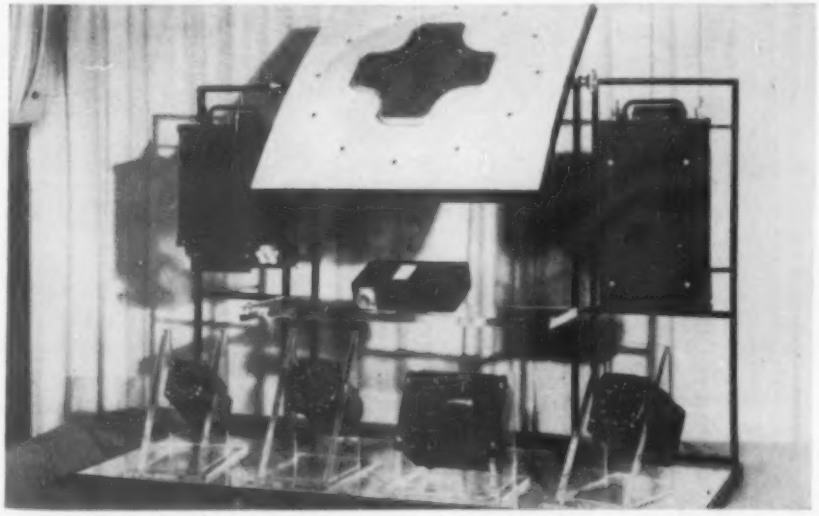
Microwave Devices

• Microwave load isolator, Model X20-L, a unidirectional device for attenuating load reflections without appreciable reduction in magnetron or klystron power, utilizes resonance absorption characteristics of ferrites. Device reportedly provides minimum isolation of 18 db., and average isolation of 25 db. over the 8.6 to 9.6 kmc. band. Maximum input VSWR with output shorted is 1.5 to 1. **Litton Industries, Components Division, 336 No. Foothill Rd., Beverly Hills, Calif.**

• Subminiature intermediate frequency amplifier, for use in airborne radar and broadband receivers, provides 100 db. gain with 12 mc. bandwidths at center frequencies of 30, 60, or 90 mc., depending upon the model. Units measure 12 x 2 x 1 in., have video output of 8v. (peak). **The W. L. Maxon Corp., 460 W. 34th St., New York.**

• Traveling wave tube amplifiers, available in three models covering the frequency range of 0.5 to 1 kmc., 1 to 2 kmc., and 2 to 4 kmc., employ voltage tuning across their frequency ranges with 5 db. bandwidths from 15 to 20% of center frequency. Gains are in the order of 10 db. at the lower frequencies and 25 db. at the high end. Devices can be used as a tunable filter or r.f. input in microwave receivers, or for intermediate amplifier applications. **Huggins Laboratories, Inc., 711 Hamilton Ave., Menlo Park, Calif.**

• Plastic foam material, designated Eccofoam Hi K, for use in microwave lens systems, antennas and the core in sandwich-type radomes, combines high dielectric constant and low weight. Material reportedly has low dissipation



NEW MINIATURE British ADF weighs only 22 lb., uses stationary, nearly-flush antenna (top center) to reduce drag. Rack-mounted receivers are shown (top) with panel indicators and console tuner (below).

Marconi Unveils 'Smallest' ADF

A new British miniaturized automatic direction finder (radio compass), weighing only 22 lb. and using a nearly flush non-rotating loop antenna, made its debut at the recent Paris Air Show, following last-minute lifting of security.

The new ADF, Type AD722, developed by Marconi's Wireless Telegraph Co. Ltd., covers the 200 to 1,700 kc. band in three tuning ranges.

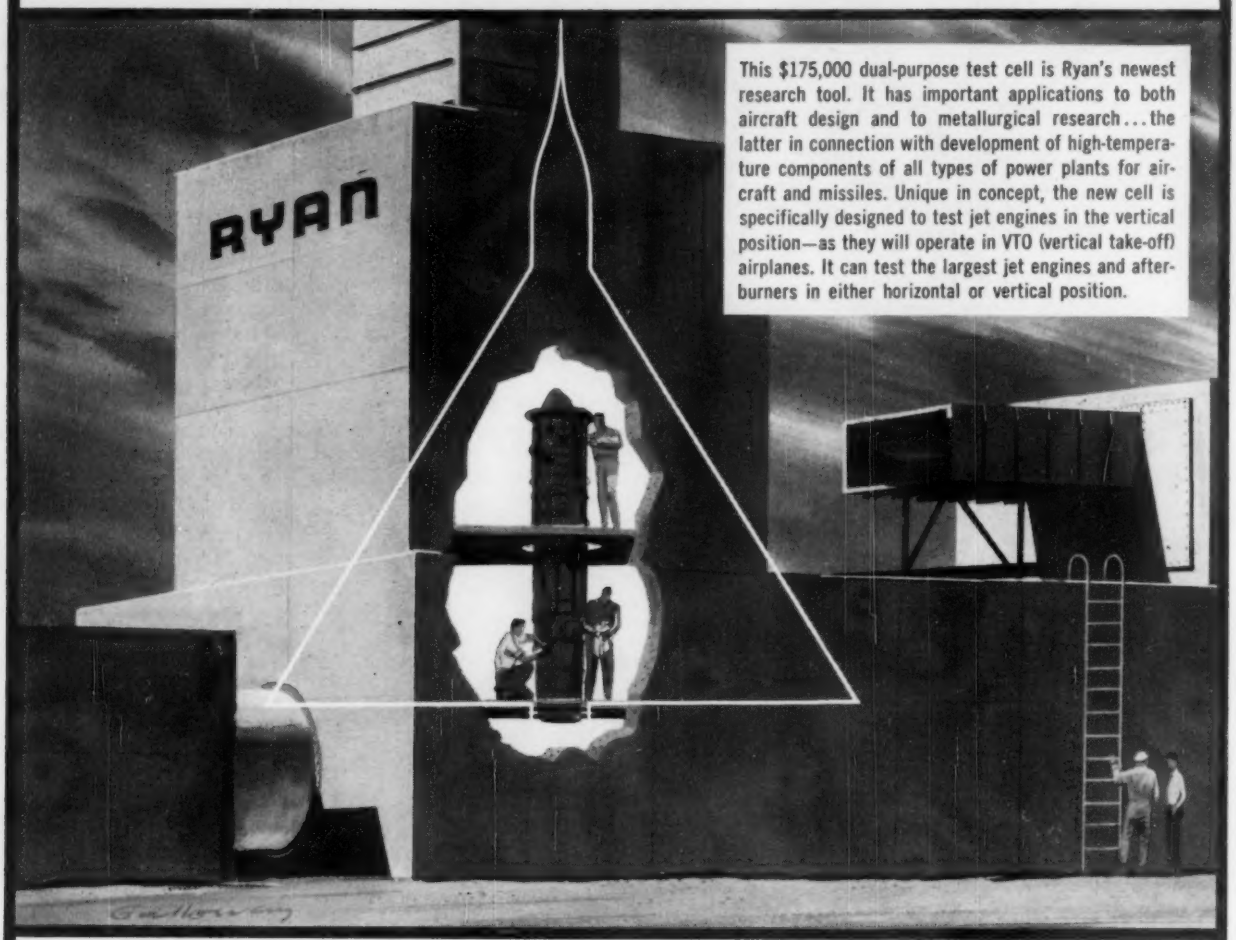
According to Marconi, the set is believed to be the smallest and lightest ADF of its type yet announced. It employs a Bellini-Tosi type of direction finding system in which the goniometer is built into the bearing indicator, with the bearing presentation pointer driven directly from the shaft of the goniometer search coil. Panel indicators are available in 3⅛ or 2½-in. dia. sizes.

The antenna, a sealed iron-core crossed-loop design with no moving parts, has a height of less than ¾ in., permitting low-drag installation without recessing the antenna into the fuselage, although the latter can be employed if desired.

Receiver units for the ADF are designed for rack mounting and remote tuning from a cockpit console. Plug-in sub-assemblies are used for simplified maintenance.

Marconi's address: Chelmsford, Essex, England.

PROVING GROUND FOR JET VTO



This $175,000 dual-purpose test cell is Ryan's newest research tool. It has important applications to both aircraft design and to metallurgical research... the latter in connection with development of high-temperature components of all types of power plants for aircraft and missiles. Unique in concept, the new cell is specifically designed to test jet engines in the vertical position—as they will operate in VTO (vertical take-off) airplanes. It can test the largest jet engines and afterburners in either horizontal or vertical position.

Another Example of How

RYAN BUILDS BETTER

This new jet engine test cell is one of many specialized research facilities used in developing the Ryan-designed jet-powered vertical take-off airplane now being built for the U.S. Air Force.

One of the most exciting and unusual aeronautical projects ever conceived, Ryan's jet VTO is a challenging new concept in military aircraft. It is typical of Ryan's forward-looking research, development and production program in aircraft—in power plants—and in electronics.

For thirty-two years Ryan has been in the forefront of aeronautical progress. Specialized, ingenious and versatile, Ryan excels in the ability to create and produce complex, high quality products at low cost—and deliver them on time.

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METALLURGICAL ENGINEERING | WEAPONS SYSTEMS | ROCKET MOTORS & RAM JETS | AIRCRAFT EXHAUST & DUCTING SYSTEMS

RYAN

AERONAUTICAL COMPANY

SAN DIEGO 12, CALIFORNIA

factor and is useable at temperatures of −65F to 275F. **Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.**

Instrumentation

● Self-balancing strain gage system, with direct-reading servo-driven indicator, reportedly is linear within 0.2% of full scale, and accurate to within better than 1% full scale. Repeatibility

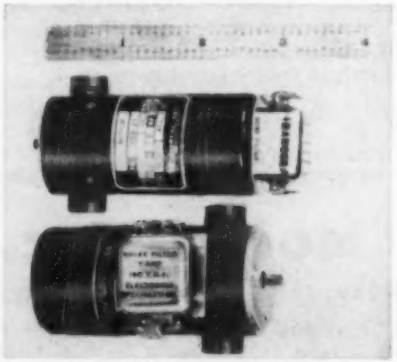
is quoted at 0.2% full scale. Equipment, which weighs under 10 lb. and occupies less than 125 cu. in., is designed for airborne use. **The Greenleaf Mfg. Co., 7814 Maplewood Industrial Court, St. Louis 15, Mo.**

● Automatic plotting board, Model G, accepts inputs from punched cards, tape and keyboard and plots on a 30 x 30 in. surface with an accuracy of one part in 1,500 or 0.02 in., whichever is greater. Numerical input of ±9,999 can be expanded to full scale or compressed to one-third scale in both X and Y directions. Roll paper may be used and a vacuum-device prevents wrinkling. **Benson-Lehner Corp., Dept. "O", 2340 Sawtelle Blvd., West Los Angeles 64, Calif.**

Components & Devices:

● Miniature relay, Series SQD, with terminals designed for insertion in printed circuit boards and dip soldering. Relay measures 1¾ x 1 x 1¾ in. Application data is available from manufacturer. **Automatic Electric Sales Corp., 1033 West Van Buren St., Chicago 7, Ill.**

● Subminiature radio noise filter for actuator motors, dual-pi type, reportedly

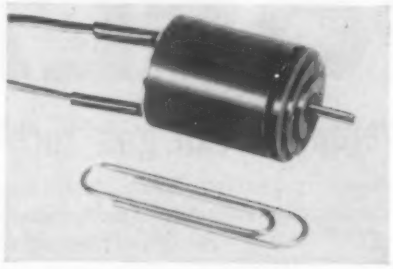


brings noise level "far below" MIL-I-6181 requirements. Unit is rated 2 amps at 200 v.d.c., measures ⅜ x ⅜ x 7/16 in., and weighs ⅜ oz. Filter can be operated at 300F. **Electronic Specialty Co., Miniature Components Div., 5121 San Fernando Rd., Los Angeles 39, Calif.**

● Silicon diodes for voltage reference use are now available in four new types, with reverse breakdown voltage ranging from 3.7 to 8.0 v., measured at 5 ma. Devices can be provided with either a positive or negative temperature coefficient. Total power dissipation for the new diodes is 150 mw. at 25C and 40 mw. at 150C. **Texas Instruments Inc., 6000 Lemmon Ave., Dallas, Texas.**

● Semi-sensitive relay, Type E B-60, requires 100 mw. operating power per pole but can be adjusted down to 25 mw. Relay contacts are rated 2 amps (resistive load) at 24 v.d.c. or 115 v., 60-400 cps. Unit will stand 10G vibration from 10 to 1,200 cps. and operate at temperatures of −65 to 125C. It comes in heremetically sealed 1 x 1 x 2 in. enclosure with solder or plug-in terminals. **Hufco Industries, Dept. R, 2815 West Olive Ave., Burbank, Calif.**

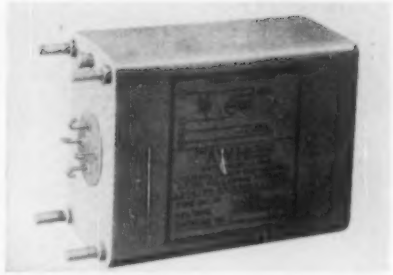
● Miniature (Size 10) synchro, Type 3G, with high permeability, for 26 v., 400 cps. use, measures 7/16 in. dia. x 1.3 in. long and weighs 1¾ oz. Angular



error spread is 20 to 30 minutes of arc. **John Oster Manufacturing Co., Avionic Div., 1 Main St., Racine, Wisc.**

● Servo motor, Model 5012-166, has a built-in clutch-brake to provide instantaneous no-slip start and stop and contains gear-reduction, all in a package measuring 1¼ in. dia. x 3⅜ in. long. Motor can be supplied in a variety of torques, output speeds and for operation from standard d.c. voltages. **Burton Manufacturing Co., 11201 West Pico Blvd., Los Angeles 64.**

● Time delay relay prevents application of plate voltage to power tubes until their heaters have reached proper temperature and provides a delayed reset in event of current interruption that is proportional to the length of



interruption. Thus, momentary power loss does not require complete time-delay recycle. Time delays of 5 sec. to 1 hr., with reset times of 30 sec. to 7½ min. are available. Timing motor is designed to operate from d.c. or 60, 400 cps. a.c. Unit can be supplied in hermetically sealed enclosure. Bulletin TD402 gives application data. **A. W. Haydon Co., Waterbury, Conn.**

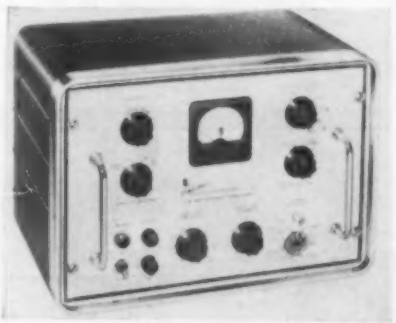
● Integral a.c. servomotor-tachometer, rated 35 watts for 115 v. two-phase 60 cps. use, has minimum lock-rotor torque of 45 oz. in. with a tach output of 6 v/1,000 rpm. For magnetic amplifier applications, 57½/57½ volt control phase windings are available. Tachometer is adjustable to reduce residual voltage. **Diehl Manufacturing Co., Finderne Plant, Somerville, N. J.**

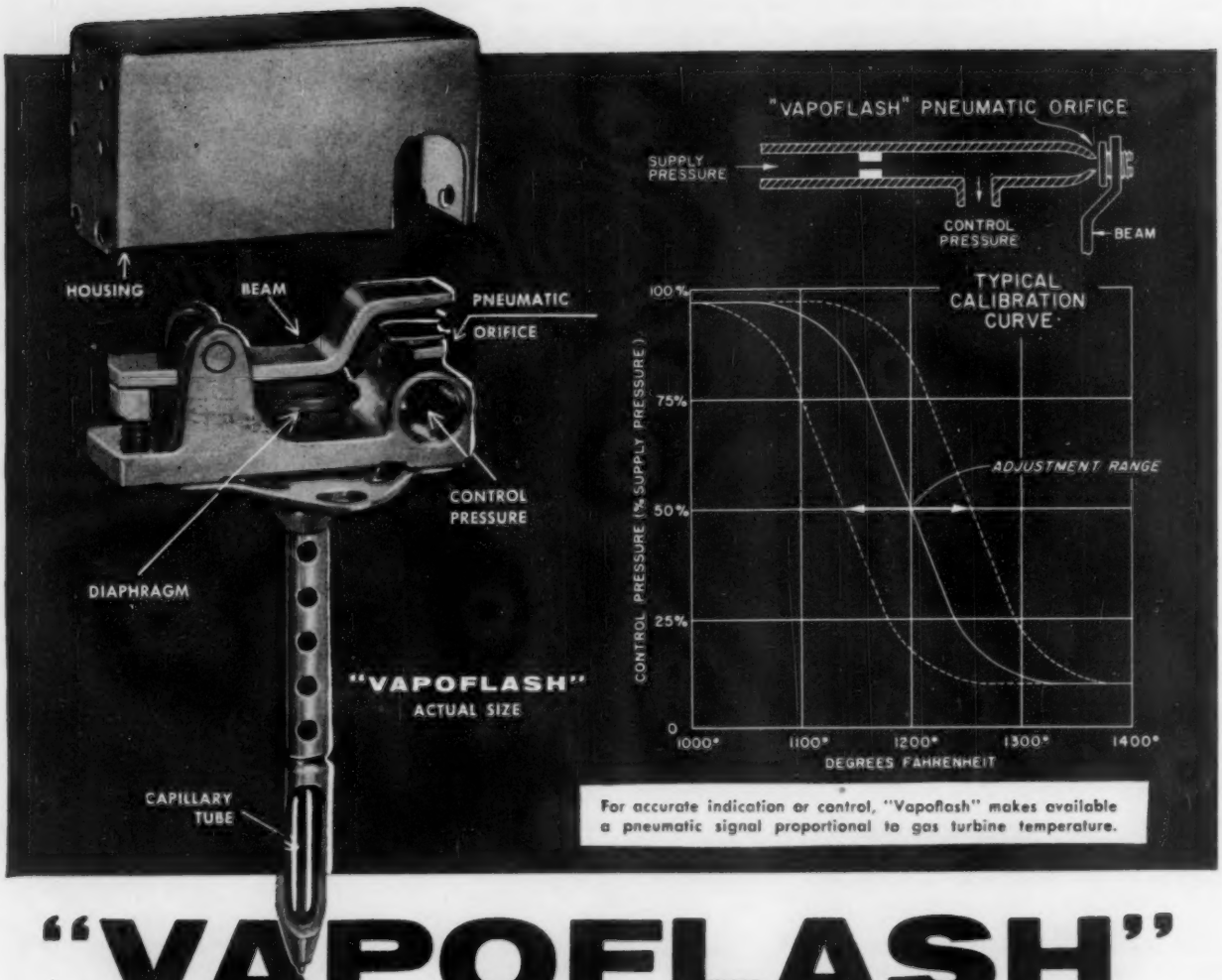
● R C & L networks, in plug-in sealed cans, are fabricated to customer specs and matched as close as 0.01%. Built-in heater and thermostat can be provided to maintain internal temperature at 75C, if required. **Eastern Precision Resistor Corp., Richmond Hill 18, N. Y.**

New Laboratory Equipment

● Microwave frequency standard, for measurement of frequencies between 2.4 and 40 kmc. to an accuracy within 0.001%, consists of a temperature stabilized crystal oscillator and multiplier-amplifier chain with outputs at 100, 500, and 1,500 mc. **Narda Corp., Mineola, N. Y.**

● Klystron power supply, Type 809, provides beam voltages of 250 to 600 v. at 65 ma., reflector voltages from 0 to −900 v. at 50μa, square wave modula-





"VAPOFLASH"

. . . an entirely new development in gas turbine control components

"Vapoflash" — a unique new measuring probe — provides the advantage of high-gain, pneumatic output. The power level of the control signal is such that greatly simplified mechanisms can be applied to modulate main engine and afterburner fuel flow, and the exhaust nozzle area of turbojet engines.

The accurately calibrated "Vapoflash" probe exposes a mercury-filled capillary tube to the gas stream of the jet engine. As the gas temperature rises to the control set point, the pressure of the vaporized mercury in the element develops a signal which is measured by a metal diaphragm. As the diaphragm moves, it actuates a preloaded cantilever beam which operates a pneumatic orifice. Compressor discharge pressure serves as supply pressure: adequate power is conveniently available for control actuation. With several "Vapoflash" units connected in parallel for averaging, reliable measurement and control of gas turbine temperatures is simplified.

We are confident that our long experience in developing, manufacturing and testing jet engine control components can be of practical service to you. Our engineering department will welcome the opportunity to analyze your control requirements.

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OUR AIRCRAFT PRODUCTS INCLUDE: TURBOJET ENGINE TEMPERATURE CONTROL AMPLIFIERS • ELECTRONIC AMPLIFIERS PRESSURE SWITCHES FOR ROCKETS, JET ENGINE AND AIRFRAME APPLICATIONS • PRESSURE GAUGES THERMOCOUPLES • HYDRAULIC VALVES • JET ENGINE AFTERBURNER CONTROL SYSTEMS.

tion between 400 and 2,000 cps. and sawtooth modulation at line frequency. **Polytechnic Research & Development Co., 202 Tillary St., Brooklyn 1, N. Y.**

● Twenty-eight-volt d.c. power supply (rectifier) is available in 11 standard models with capacities up to 1,500 amps. It provides voltage regulation of ½%, d.c. ripple of 1% and recovery time of 0.1 second. **McColpin-Christie Corp., 3410 W. 67th St., Los Angeles 43, Calif.**

● Adjustable d.c. power supply, Model 406, provides 0 to 530 volt output at 100 ma. and is equipped with vernier controls which permit voltage to be set to any desired value within 2 mv. over the entire range. Regulation is quoted at 0.01% or 50mv. for 20% line voltage variation or full 100 ma. load change. Ripple is less than 1 mv. and short term stability is better than 0.01%. Auxiliary outputs are 0 to 225 volts bias and 6.3 v., 3 amp a.c. for filaments. **John Fluke Manufacturing Co., Inc., 111 W. Nickerson St., Seattle 99, Wash.**

Avionics Expansions Here and Abroad

A new firm Ketay Ltd., has been formed by Norden-Ketay Corp. of the U. S. and Plessey Co., Ltd., of England, to manufacture synchros and servo mechanisms in Britain. Plessey will provide the manufacturing facilities and personnel while Norden-Ketay will provide engineering, design and manufacturing information.

Other recently announced expansions in the avionics industry include:

• **Barnes Engineering Co.** is the new name of former Olympic Development Co., of Stamford, Conn. Originally established as the development division of Olympic Radio & Television Co., Barnes Engineering Co. is now an independent engineering and manufacturing company headed by Dr. R. B. Barnes. The company's activities include development and manufacture of infrared components and devices.

• **Convair-San Diego** has added two new special-purpose machines to its computing center. They are CRC-105 decimal digital differential analyzers manufactured by the Computer Research Div. of National Cash Register Corp.

• **Hamner Electronics Co., Inc.,** Princeton, N. J., has been organized to develop and manufacture research and test instruments.

• **CBS-Columbia** has converted approximately one-fourth of its Long Island City, N. Y., plant to the manufacture of government and industrial electronics.

Nothing Less than this ALL-ANGL Mount gives sure protection in JETS and MISSILES

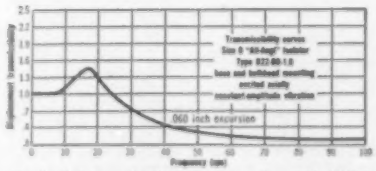
WHY? Because this Barry mount is independent of operating or mounting position. Through every operational maneuver of jets, VTO's, and missiles, the ALL-ANGL gives the same effective shock and vibration protection as in level flight.

These are the vital performance characteristics of the ALL-ANGL Mount:

- Equal stiffness in all directions
- Equal damping in all directions
- Low transmissibility at resonance — less than 3
- Isolation under superimposed steady state accelerations up to 5 g

Maximum load ratings of Size 0 ALL-ANGL mounts now available are 0.5 to 3.0 pounds per mount, in four ranges.

Write today for Data Sheet W5. For specific recommendations, call your nearest Barry Sales Representative.



Typical transmissibility curve for ALL-ANGL mount, both base and bulkhead mounting, excited axially at constant amplitude.

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	1955	1954	Gain
Aviation Week	**2,314.77**	**1,935.02**	**+ 379.75**
American Aviation	787.25	624.59	+ 162.67
Aviation Age	1,265.82	1,144.07	+ 119.75
Aero Digest	351.25	463.68	– 112.43

*Source — Aviation Week Research Dept.

†All magazines listed have published one special issue during 7 mo.-period.

Here is the story of another big advertising gain for AVIATION WEEK – a smashing 380-page increase for the first seven months of 1955! With 2,315 advertising pages published through July, 1955 compared to 1,935 for the first seven months of 1954, AVIATION WEEK is setting new records for advertising volume and gains. As the chart indicates, AVIATION WEEK's gain exceeds the increase of all other magazines listed by a substantial margin, even though 1955's record was achieved in the face of the largest advertising volume of any magazine serving the aviation industry. AVIATION WEEK published 3,520.16 pages of advertising in 1954.

WHAT'S BEHIND THIS uninterrupted, ever-growing trend to AVIATION WEEK? – Aviation advertisers have long ago learned what real readership means in terms of results. Aviation Week's more than 50,000 engineering and management readers compose today's most resultful and influential aviation market.* That is one of the important reasons why AVIATION WEEK today is the one and only aviation magazine among the ranks of the top 25 U. S. Consumer and Business Publications.

* Aviation WEEK's *tremendous readership among engineers and management men* has been proven through the years by 37 independently conducted reader-preference studies by major aviation companies, their advertising agencies, and by government research establishments . . . is further validated by Advertising Research Foundation's current study of AVIATION WEEK, Readex studies, and a continuing program of editorial research by the Research Department of the McGraw-Hill Publishing Company. AVIATION WEEK's top-level subscriber group now totals 49,368 (December, 1954 ABC audit) with the current weekly print order exceeding 56,000 copies and the current net paid figure (May, 1955), 52,850.

Contact your local representative for the facts about Aviation Week and the booming aviation market.

Box Score for Top News Stories
1955 (First Seven Months)

93%
Readership

1. Three-page feature article, "Russian Jet Airpower Gains Fast on U.S." by Chief Editor Robert Hotz. Exclusive story in Aviation Week set off world-wide reaction, contributed to increased U.S. aircraft production.

78%
Readership

2. Three-page production article, "F4D Meets Challenge of Engine Change," by Senior Engineering Editor Irving Stone.

70%
Readership

3. Four-page engineering article, "Scientists Clear Wind Tunnel Throats," by Senior Engineering Editor David A. Anderton.

69%
Readership

4. Four-page avionics article, "Line of Sight 'Barrier' Latest to Fall," by Avionics Editor Philip Klass.

Readership measured by Readex Reader Interest Reports, Inc.

AVIATION WEEK

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NUMBER 3 OF A SERIES

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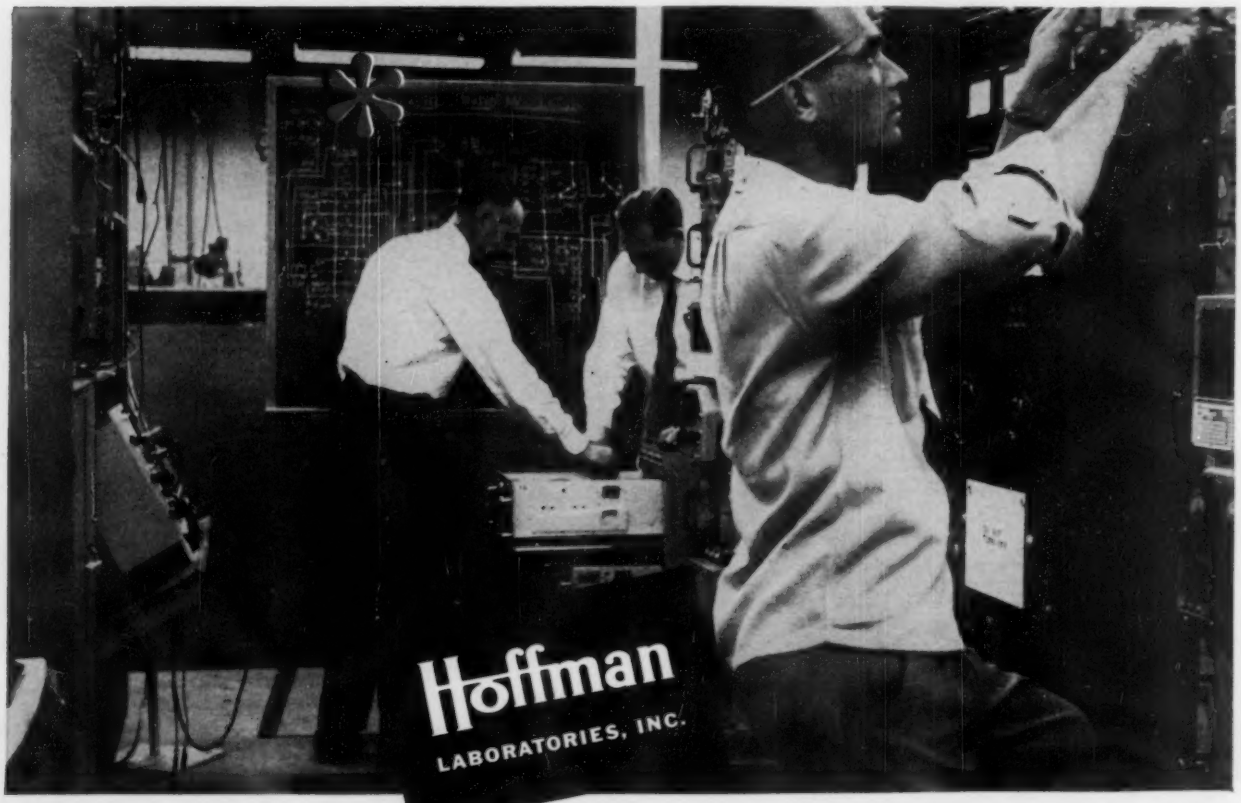

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WHO'S WHERE

(Continued from page 9)

D. W. Berry, assistant chief engineer and director of development of the Aviation Gas Turbine Division, Westinghouse Electric Corp., Kansas City, Mo.

Robert S. Butts, assistant chief engineer, Melpar, Inc., Falls Church, Va.

D. E. Fry, assistant manager of purchasing and material control for Allison Division of General Motors Corp. **H. R. Kelly,** purchasing agent.

Charles D. Perrine, Jr., assistant division manager engineering of Convair, Pomona, Calif.

Walter D. Peck, export manager of Piasecki Helicopter Corp., Morton, Pa.

Douglas J. Ingells, public relations, Air Transport Assn.

A. M. Gonnella, service manager, Pilotless Aircraft Division of Boeing Airplane Co.; **Ward E. Parsons,** director of spares department.

Harold H. Winton, sales manager, Precision Components Division of Norden-Ketay Corp., Milford, Conn. and **Boone T. Guyton,** sales manager of Instrument and Systems Division.

Jitsuro Kobayashi, assistant to the general manager of sales for Japan Air Lines.

Hervey Baribault, sales and service representative, Aircraft Controls Division, General Controls Co., Glendale, Calif.

H. M. Clarke, North American sales planning and tariffs manager for British Overseas Airways Corp.

H. W. Caward, system chief pilot for Western Air Lines; **Lester C. Holtan,** regional chief pilot for the airline's Pacific Coast Operations Division.

Arnold Armstrong, superintendent, Jet Engine Component Production Division, Portland Copper & Tank Works, Inc., Portland, Me.

Jack S. Williams, station ground services manager for United Air Lines at Spokane.

Arne Wickberg, chief sales executive for Stockholm-Saltsjobaden. Wickberg formerly was regional sales director in Sweden for Scandinavian Airlines System.

Walter P. Targoff, assistant director of Cornell Aeronautical Laboratory's aero-mechanics department. Other changes: **Richard P. White, Jr.,** head of the new aeroelectric research section; **Jack Lotsof,** head of the dynamic analysis section.

Cale H. Merrill, aircraft application engineer for Vickers, Inc., Detroit.

Ralph A. Trankina, Chicago district sales manager for Airwork Atlantic Ltd.

Ralph E. Martin, plant superintendent for Nasco Service Corp.

Robert T. Schultz, chief engineer of Nader Manufacturing Co.'s Electronics Division, Monrovia, Calif. Schultz formerly was on the technical staff of Hughes Aircraft Co.

Bill L. Waddell, senior systems development engineer for the Datex Division of G.M. Giannini & Co., Inc.

Stephen J. Facsko, assistant cargo manager of Braniff International Airways.

Richard L. Templin, assistant research director for Aluminum Company of America, elected an honorary member of the American Society for Testing Materials.

Photo courtesy
Herman Nelson Division, American Filter Co., Inc.

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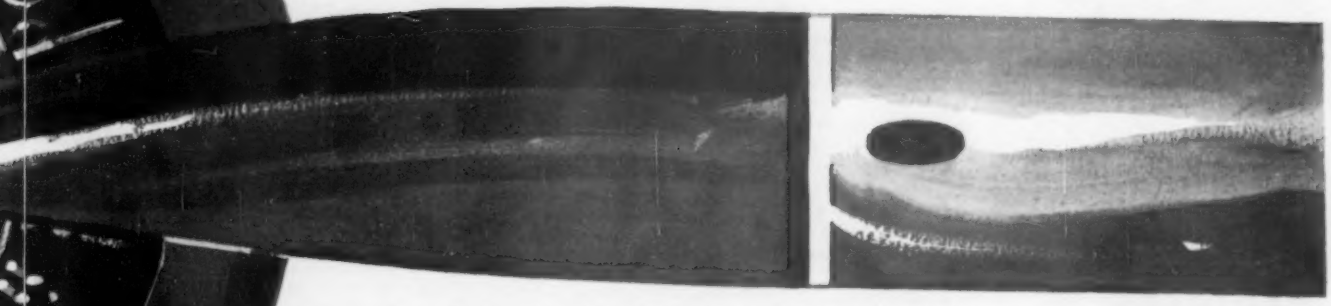

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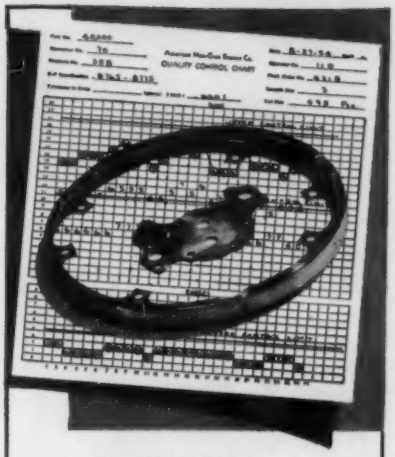

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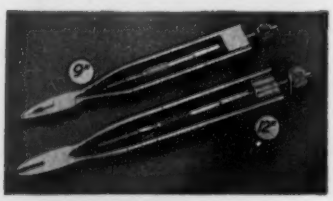

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AVIATION SAFETY

Report on BOAC Stratocruiser Crash

Steep Letdown Led to Accident

Report of the Public Inquiry into the causes and circumstances of an accident which occured on the 25th December, 1954, to the Boeing Stratocruiser Aircraft G-ALSA

(Unless otherwise stated all times in this Report are Greenwich Mean Time, all bearings are magnetic and all distances are in nautical miles)

INTRODUCTION

1. At about 2158 hours on 24th Dec., 1954, a Boeing Stratocruiser Aircraft G-ALSC (hereinafter called "Sugar Charlie") owned and operated by British Overseas Airways Corp. (hereinafter called "BOAC") took off from London Airport on a flight to Prestwick. It was manned by a crew of 11, and carried 25 passengers and a quantity of cargo. The flight had been scheduled to leave London at 1745 hours, but a delay was occasioned through a passenger being flown from Manchester to London to join the aircraft there.

Owing to the failure of the port wheel to retract on takeoff it became necessary for the aircraft to return to London and in order to make a safe landing some petrol had to be jettisoned. Ultimately a landing was made at London Airport about 2245 hours.

2. Arrangements were made to transfer crew, passengers and cargo en bloc to another Boeing Stratocruiser G-ALSA (hereinafter called "Sugar Able"). The crew comprised a Captain, First Officer, Navigating Officer, Radio Officer, 3 Engineer Officers, 3 Stewards and 1 Stewardess. One of the Engineer Officers was supernumerary.

The ultimate destination of the aircraft was New York, but the crew were only to travel as far as Prestwick where a fresh crew were to take the aircraft over the Atlantic. Sugar Able took off from London Airport at 0120 hours on 25th Dec. for Prestwick.

3. The flight from London to Prestwick was uneventful. Throughout the flight the Captain kept in touch with the weather conditions and Prestwick Approach Control received the aircraft about 0248 hours. Preceding Sugar Able by approximately four minutes in arrival at Prestwick Airport was a Constellation aircraft G-AMUP (hereinafter called "Uncle Peter"), and these two aircraft were fed into the stack at Prestwick; Uncle Peter at 4,000 feet and Sugar Able at 5,000 feet. The runway to be used was Runway 31 which required the approach to be made from the south east. The Instrument Landing System (hereinafter called "ILS") without the Glide Path and the Ground Control Approach system (hereinafter called "GCA") were available on Runway 31.

GCA took over Sugar Able about 0314 hours and at 0323 hours the talk-down controller took over the aircraft. Meantime meteorological reports had been passing from ground to air. The talk-down was completed at 0325 hours when the aircraft was 400 yards from the threshold of Runway 31. The approach up to this point had been high but uneventful.

A few seconds later the aircraft struck the ground 127 feet short of the threshold of Runway 31, sustaining some damage. It then ran on to the runway and proceded for some 90 feet where it was again airborne for another 400 feet. It then contacted the runway and sustained considerable damage, and came to rest with the passenger compartment in an inverted position on the south side of the runway about 550 yards from the threshold. Except for the front portion of the fuselage which lay on its port side, severe damage resulted from fire which broke out and spread rapidly due probably to the partial detachment of the port wing and rupture of the fuel tanks.

4. From the accident there survived seven of the crew and one passenger.

5. The main tasks of the Court were (a) to discover the cause of the accident (b) to decide whether GCA functioned correctly and (c) to decide whether weather conditions caused or contributed to the accident.

THE AIRCRAFT

6. Sugar Able was a Stratocruiser built by the Boeing Airplane Co. in the United States of America in 1949. It was powered by four Pratt & Whitney R4360 B6 engines, each of 3,500 hp. It held a Certificate of Airworthiness dated 3rd Dec., 1949, which was a validation of a Certificate of Airworthiness issued abroad. The validation certificate was renewed from time to time, the last renewal being valid up to 2nd Oct., 1955. The aircraft also held a Certificate of Maintenance issued at London at 2330 hours on 24th Dec., 1954, valid for 125 flying hours which period had not elapsed at the time of the accident.

Its permitted takeoff weight was 145,800 lb. It was equipped with MF/HF Communication Equipment and held a valid Radio Licence, together with a Certificate of Serviceability. It was also provided with VHF Communication Equipment, AD/F and ILS Equipment.

THE CREW

7. Capt. William Laing Stewart was in command of the aircraft and at the material time he was in control. He was aged 45 and held an Airline Transport Pilot's Licence issued 2nd June, 1949, valid to 14th Jan., 1955, endorsed for Stratocruiser group. He completed his Boeing 377 training in March 1951. He was engaged by BOAC in 1936 and graduated to Senior Captain 1st Class on 1st Apr., 1947. His flying experience was 10,569 hours. Of these flying hours Capt. Stewart had flown 141 hours by day and 184 hours by night as 1st Pilot and four hours

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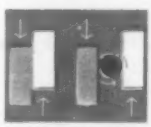
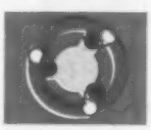
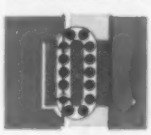


Let's start with the familiar principle that there's far less friction in *rolling* than in *sliding*. The average coefficient of friction of the sliding spline is .2—while that of the ball/bearing spline is only .005.

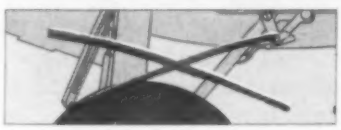


By applying this principle, the *Safety b/b Spline* radically increases the efficiency of transmitting or restraining high torque loads. Instead of *sliding* against each other, the mating surfaces *glide* on rolling balls.



The steel balls recirculate in closed circuits formed by mating longitudinal raceways spaced around the circumference of both the inner and outer splines. Ball guides return the balls to their starting point.

HOW THE Safety b/b Spline CAN HELP SOLVE YOUR AIRCRAFT ACTUATION PROBLEMS



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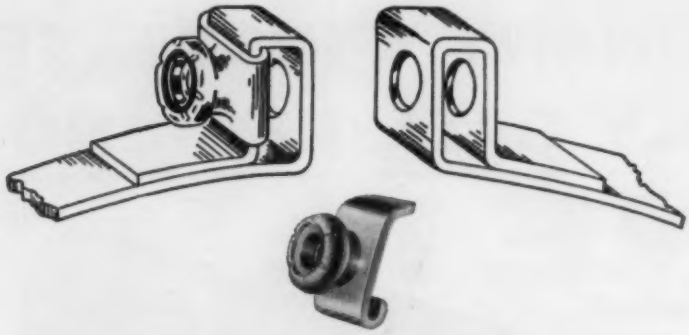

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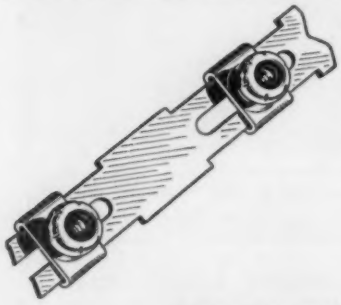
Applications where standard sized clamps are not promptly available to meet specific dimensional requirements are continually occurring. Attaching a phenolic hydraulic tube block to the air frame structure, for example. Or on the deflector clamps that attach a baffle to the cylinder of an aircraft engine. Design engineers asked for a versatile design that would permit fast, economical, on-the-job customizing to meet exactly the requirements of the application.

On the engine application, ESNA's new N1999-02 self-locking clamp nut replaced a nut brazed to the strap. The ESNA nut costs less and eases maintenance because it can be replaced without discarding the entire clamp. In addition, when used with a slotted strip (see small illustration) the free location of the N1999-02 provides a wide range in the size of the object to be clamped.

Like all Elastic Stop nuts, the N1999-02 is self-locking, vibration-proof and reusable. As a "stop" nut the tight grip of the red nylon locking collar maintains a precise adjustment at any predetermined point along bolt threads. And simply wrapping the one lug around the strap is a far simpler and less expensive assembly than double nuts or soldered nuts.



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Elastic Stop Nut Corporation of America
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Please send me the following free fastener information:

☐ Details on N1999-02 Clamp Nut

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

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by day and three hours by night as 2nd Pilot within the last six months. His last six-monthly check dated 6th July, 1954, was satisfactory. His confidential reports were satisfactory throughout and he was described as a sound and capable Pilot.

Capt. Stewart had considerable experience of four-engined aircraft and had 1,500 hours flying experience in Stratocruisers, the majority of these hours being on the North Atlantic run. He had landed at Prestwick nearly 200 times. Capt. Peacock, Fleet Manager Stratocruisers, BOAC, described Capt. Stewart as considerably above average as a pilot.

8. First Officer Kenneth Arthur King was aged 35 and held a valid licence to fly in command of a Stratocruiser. During the war he was in the Royal Air Force and acted as Flight Commander at an instruction school. For his services he was awarded the Distinguished Flying Cross. He joined BOAC in 1946 and was appointed Senior First Officer on 1st Apr., 1953, and on 1st Oct., 1953, he was posted to Stratocruiser and Constellation Fleet. His flying experience totalled 6,579 hours of which he had during the last six months completed 158 hours by day and 166 hours by night on Stratocruiser aircraft. His last six-monthly check dated 5th Nov., 1954, was satisfactory. His reports were satisfactory throughout.

In 1950 he was commended for his quick reaction and precise execution of orders when acting as First Officer on a York aircraft and one engine failed when the aircraft had passed the critical point during takeoff.

9. Navigating Officer John Goddard who was aged 40 and held a current Flight Navigator's Licence was not shown to have taken part in the events leading up to the accident.

10. Radio Officer Frank Herbert Frape was aged 48 and held a current 1st class Flight Radio Officer's Licence. He had been with BOAC since 1938 and his reports were generally very good, being described as capable and reliable.

11. Engineer Officer George Carswell Wilson was aged 41 and held a Flight Engineer's O Licence current at the date of the accident. He had a total of 6,882 hours flying experience of which 3,002 had been on Stratocruisers. His reports were generally satisfactory. He was acting as Chief Engineer when the accident happened.

12. Engineer Officer Philip Thomas Monk, aged 36 years, held a current Flight Engineer's O Licence. His flying experience was 6,747 hours of which 2,835 were on Stratocruisers. His reports were satisfactory. He was acting as 2nd Engineer Officer at the time and took no part in the events leading up to the accident.

13. Flight Engineer Louis Bignell Pulsford was supernumerary and flying as a passenger.

14. Stewards Charles Ness, Stanley Progin, John Albert Hall and Stewardess Margaret Coogan all had excellent reports.

THE PASSENGERS AND CARGO

15. When the aircraft left London there were on board 25 passengers, of whom 21 were booked to Prestwick and 4 were booked to New York. She carried some cargo and the load was properly distributed. The actual laden weight at takeoff was 126,982 lb. which due to fuel consumed in flight enabled the aircraft to land at Prestwick within

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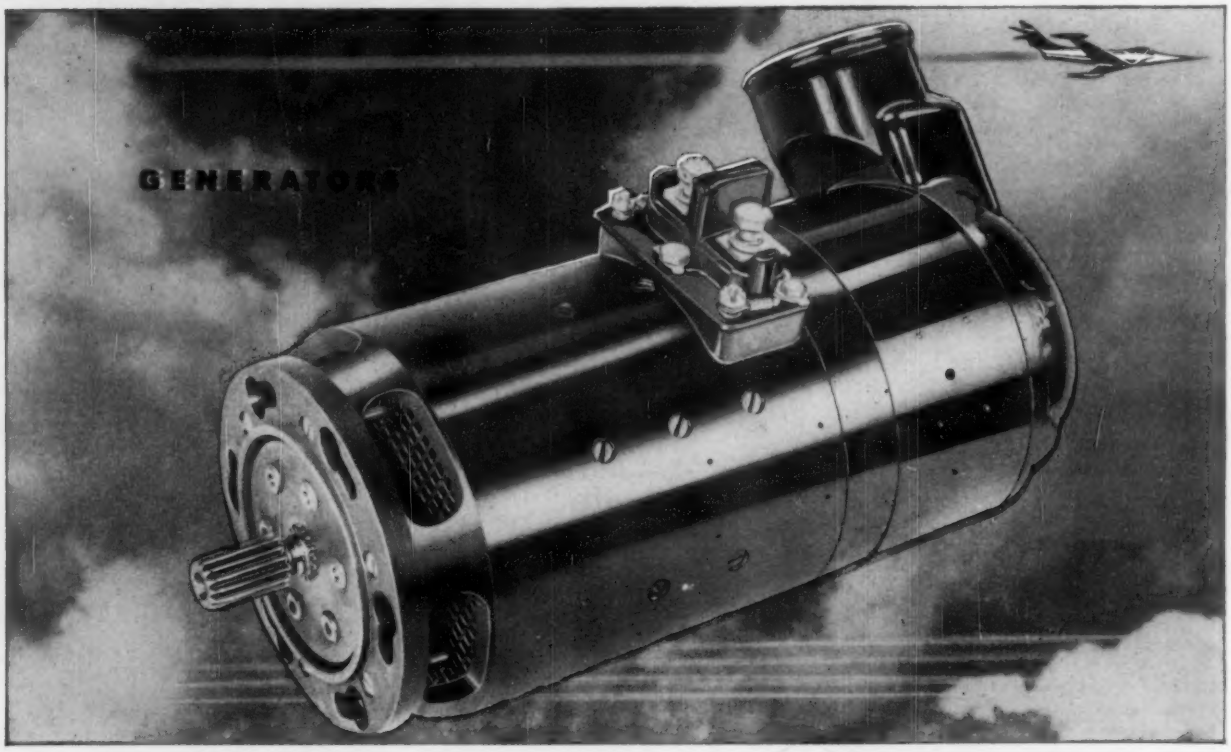

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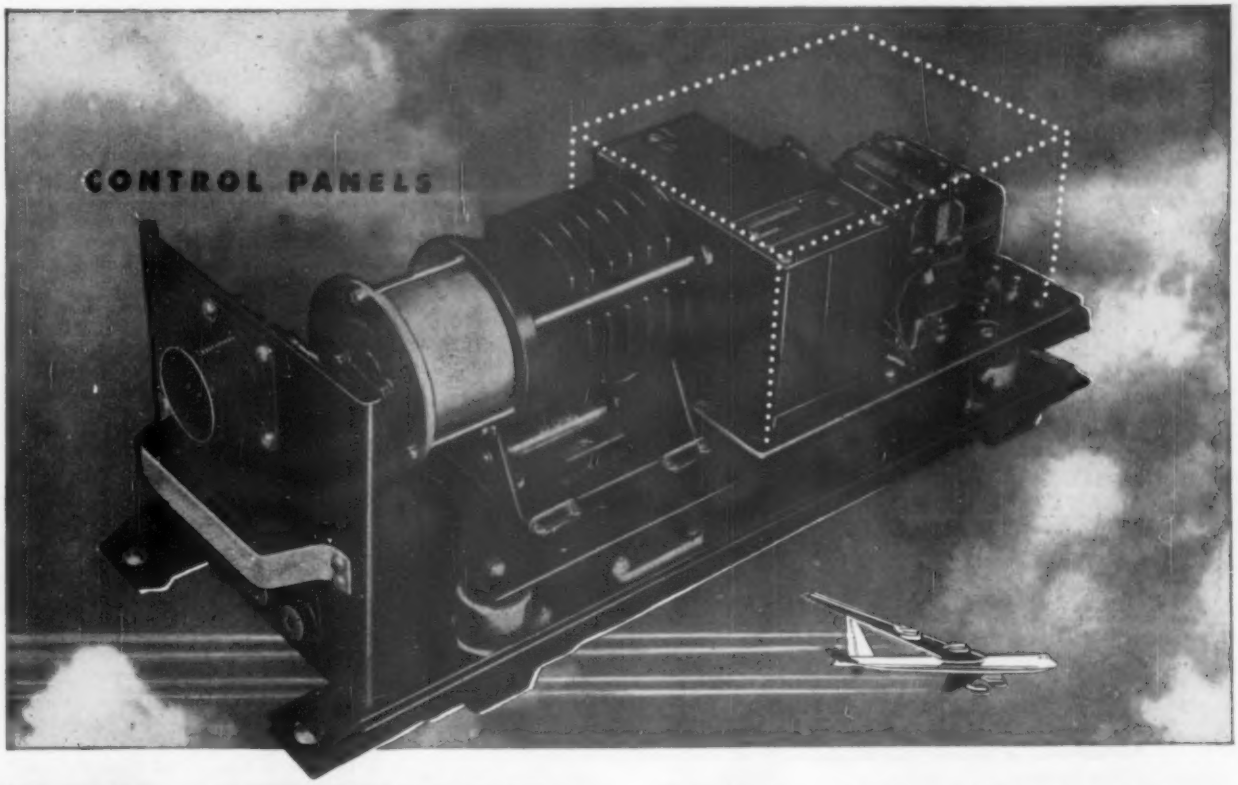

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THE AERODROME AND LIGHTING AT PRESTWICK

16. Runway 31 is 6,997 feet long which is amply sufficient for a Stratocruiser to land in safety. The runway lights consist of two rows of white lights spaced at 200 feet apart and of variable intensity; each row of white lights is inset 75 feet from the edge of the runway and laterally there is a distance of 150 feet between the rows. At 120 feet from the east end of the runway there are green threshold lights inset 75 feet from each edge of the runway. The approach lights consist of a single line of sodium and red intensity lights spaced back from the threshold at regular intervals of 300 feet for a distance of 3,000 feet. There was no Crossbar System of lighting installed.

17. There was a GCA system in operation, the purpose of which is to give the pilot guidance in azimuth and along the glide path. The glide path is 3½° to the horizontal. The GCA touchdown point is 1,235 feet from the end of the runway. The runway falls 16 feet in the 1,235 feet between the threshold and the GCA touchdown point, and thereafter a further 15 feet.

THE WEATHER

18. Before Capt. Stewart left London he received a Flight Forecast for the route from London to Gander via Prestwick and a weather briefing at about 0005 hours on 25th Dec. from the Senior Forecaster on duty.

The Prestwick weather conditions were forecast as follows: The surface wind direction 230 degrees true, speed 12 knots; the surface visibility 3 miles, occasionally 1,700 yards; the weather, occasional drizzle; the cloud structure, 4/8th stratus, cloud base 800 feet, with 8/8th strato cumulus, cloud base at 1200 feet with occasionally ⅜th stratus, cloud base 400 feet and 8/8th stratus 800 feet.

In view of the weather actually encountered at Prestwick the above forecast proved remarkably accurate reflecting the greatest credit on the system and those engaged in the preparation of the forecasts.

19. Icing conditions were experienced by Sugar Able at 8,500 feet, but the anti-icing and de-icing systems of the aircraft were operating and no difficulty was encountered due to icing conditions.

As has already been stated, preceding Sugar Able was the Constellation aircraft Uncle Peter, also owned by BOAC. She was received into the stack at Preswick at 4,000 feet and Sugar Able at 5,000 feet. At 0248 hours Uncle Peter received a weather report from Prestwick Approach that the surface wind was 270, six knots, surface visibility was 2½ miles with slight continuous rain, cloud 8/8th at 1,200 feet, ⅜th at 500 feet and ⅛th at 300 feet; the runway in use was Runway 31. This message was also received by Sugar Able which was at that time on the same frequency.

At 0249 hours Sugar Able received the same weather report direct from Prestwick Approach and was given QNH as 1012 millibars. At 0250 hours Uncle Peter and Sugar Able received an amended report on the cloud 8/8th at 1,200 feet, 6/8th at 700 feet and ⅜th at 400 feet and that "there

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. . . and in addition—

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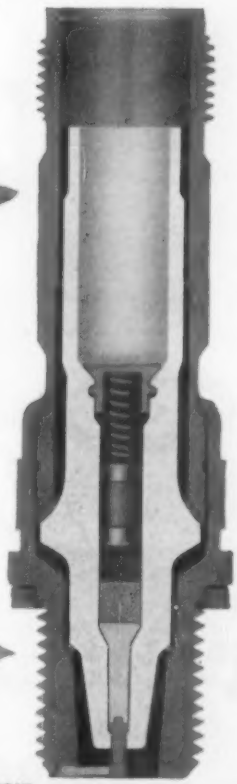

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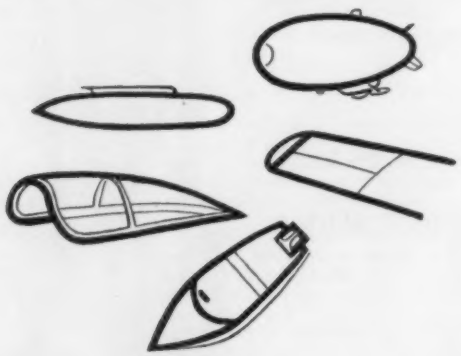

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appears to be cloud on the approach Runway 31." Uncle Peter was then informed of a delay due to a technical fault in GCA which kept the aircraft in the stack for some seven minutes while the fault was rectified.

At 0301 both aircraft received a further weather report which indicated surface wind 270, seven knots, visibility 2½ miles, with continuous slight rain, cloud 8/8th at 1,200, 6/8th at 700, 4/8th at 400, ⅛th at 100 feet and again referred to patches of cloud on surface on approach to Runway 31. At 0312 hours Uncle Peter received another weather report and landed at 0318.

At 0318 Sugar Able asked GCA to give a report from Uncle Peter on the cloud state which he had experience during landing. In answer to this request Sugar Able was informed at 0320 by GCA that Uncle Peter reckoned he broke cloud at 700 feet and that the visibility was 2½ miles. A further amended report was passed by GCA to Sugar Able at 0322 hours to the effect that Uncle Peter had reported that although he broke cloud at 700 feet there was a layer of cloud below that again. This report was later confirmed by the Captain of Uncle Peter who said in evidence that he became visual at 700 feet, when he was about two miles from touchdown and that he remained visual for the rest of his approach until his touchdown. Capt. Stewart on his final approach broke cloud at 700 feet when he could see the extreme end of the runway lights and he remained visual until the last few seconds before the aircraft hit the ground. During these last few seconds the visibility had become somewhat reduced due to the presence of low scud clouds on the approach to Runway 31.

20. The Weather minima laid down for pilots of BOAC are contained in the Operations Manual for Boeing 377. The critical height for Runway 31 at Prestwick during this approach was 600 feet and the visibility 1 mile. It is provided by Paragraph 4.3(i) (a) of the Manual: "When using a recognised runway approach system a Captain must not descend except in emergency below his critical height unless he is completely satisfied that he can thereafter continue his approach and landings by continuous visual reference to the ground or to the visual aids provided. This clearly indicates that no cloud is acceptable upon the approach path below the critical heights."

While the meaning of the first sentence of this paragraph is clear, the interpretation to be placed on the second sentence is not so clear. On one reading of this latter sentence it would prevent a pilot landing if there was cloud between him and the ground on his approach path notwithstanding that the intended glide path was clear. But this was not the interpretation placed on this sentence either by BOAC or by any of the pilots who gave evidence. It is in practice interpreted in the sense that a pilot may land although there is cloud below his critical height on the approach path, provided the glide path is clear. On this interpretation, if Capt. Stewart's evidence that he became visual at 700 feet, when he could see the end of the runway, is true, his decision to land at this stage was a correct one.

In any event weather conditions played no part in this accident until the talk-down had been completed.

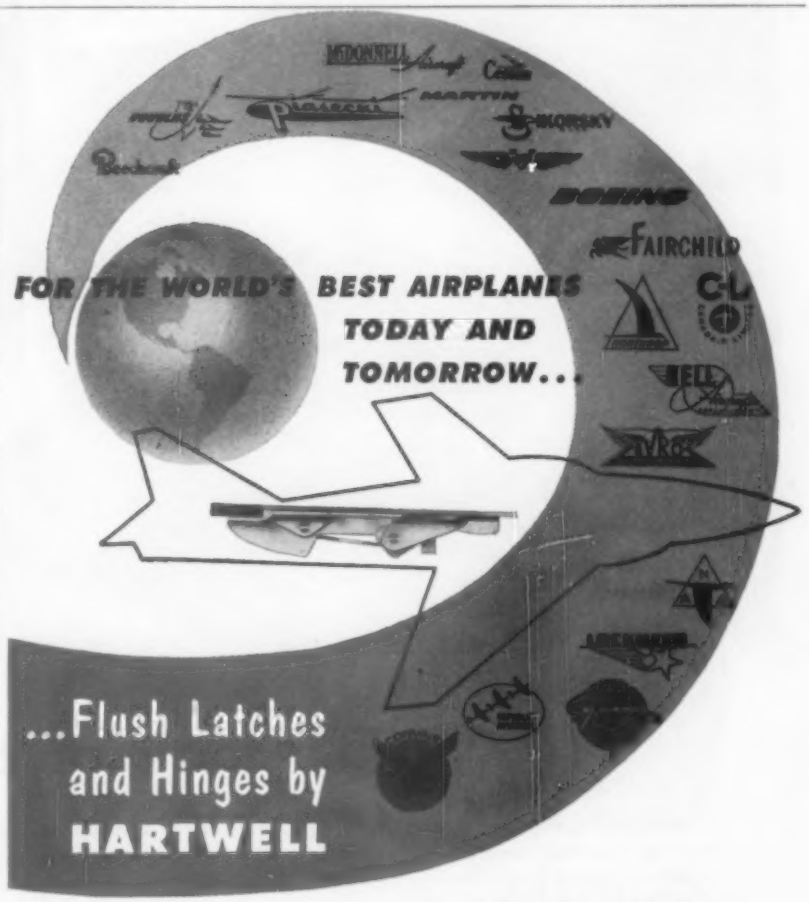
21. The wording of Paragraph 4.3(i)(a) of the BOAC Boeing Operations Manual leaves a great deal to be desired for clarity and if the interpretation placed on the second sentence is to be the meaning of the clause, this should be made clear by an amendment.

EVENTS LEADING UP TO THE ACCIDENT

22. The Court was in the unusually favourable position in having the evidence of both the Captain and the First Officer as to the events preceding the accident.

As has already been stated, the flight was uneventful until the aircraft arrived in the stack over Prestwick about 0257 hours. While the aircraft was in the stack, the landing lights were extended and checked and left in the extended position. When Capt. Stewart received the weather report above referred to at 0301 hours, he, in common with the Captain of Uncle Peter, decided that there was nothing to prevent his landing. There was a 700 feet ceiling, being the lowest altitude at which more than 4/8th of the sky is covered with cloud.

Capt. Stewart, however, in view of the other weather reports given to him was not unprepared to find patches of cloud beneath him on the final approach. He decided to proceed to his Critical Height. At 0319 Sugar Able was given QNH 1012 millibars which was duly acknowledged. At 0321 Sugar Able was just coming up on the final approach and given a heading of 305 degrees and told to descend to 2,000 feet. Thereafter Sugar Able was given headings from time to time by GCA which were in turn



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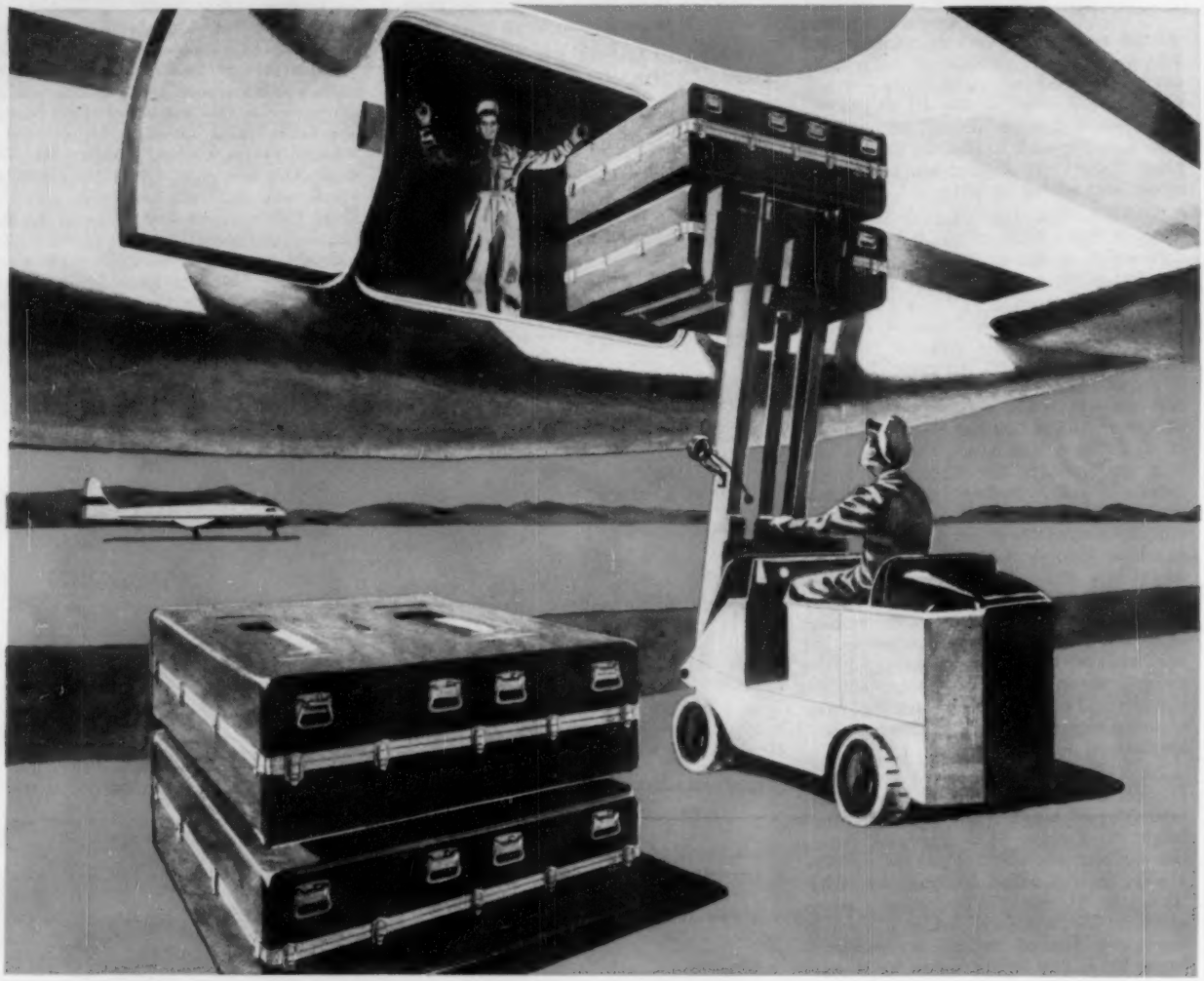

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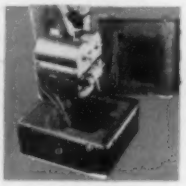

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acknowledged. At 0323 the final talk-down commenced and finished at 0325 + 44 seconds.

The recorded talk-down is as follows with the calculated times:—

Time	
0323	Ah, that is correct three one five, do not acknowledge further instructions, check your minima, turn left felt five degree heading three one zero, I say again heading three one zero,
0323+14	five and a half miles from touchdown, check wheels down and locked, you are right of the centre line slowly closing on heading three one zero,
0323+22	five miles from touchdown, shortly approaching the glide path, heading three one zero,
0323+30	begin your descent now at six hundred feet per minute,
0323+34	four and a half miles from touchdown, turn left left five degrees heading three zero five, I say again heading three zero five, and you are
0323+43	settled on the glide path now, on the glide path, three zero five is your heading,
0323+49	four miles from touchdown, heading three zero five, and you are just
0323+55	fifty feet above the glide path now, heading three zero five, turn right three degrees heading three zero eight, I say again heading three zero eight,
0324+4	eighty feet above the glide path now, eighty feet too high,
0324+09	three and a half miles from touchdown turn right a further three degrees heading three one one, I say again heading three one one and you are still
0324+17	eighty feet above the glide path, three one one is your heading,
0324+22	three miles from touchdown, fifty feet high now, forty, thirty,
0324+27	twenty, on the glide path now, heading three one one,
0324+32	on the glide path now, your heading is three one one,
0324+35	two and a half miles from touchdown, turn left left three degrees heading three zero eight, I say again heading three zero eight, and you are
0324+41	going above the glide path now,
0324+44	one hundred feet too high, one hundred and thirty feet above the glide path now,
0324+48	one hundred and forty, heading three zero eight,
0324+51	two miles from touchdown, obstacle clearance limit is two six three feet, turn left three degrees heading three zero five,
0324+58	eighty feet above the glide path now, fifty feet high, coming back to the glide path, and
0325+4	on the glide path now, heading is three zero five,
0325+7	one and a half miles from touchdown,
0325+8	on the glide path, heading three zero five is good, and you are just
0325+13	twenty feet high now, turn right three degrees heading three zero eight
0325+18	one and a quarter miles from touchdown,
0325+19	sixty feet high now, turn right a further three degrees heading three one one,
0325+25	one mile from touchdown, you are one
0325+26	hundred and fifty feet above the glide path, two hundred feet above the glide path now, if you are overshooting, climb to one five zero zero feet on heading three one one.
0325+36	three quarters of a mile from touchdown, I will continue with talkdown.
0325+40	one hundred feet high now, and
0325+42	four hundred yards from the runway, talkdown completed.
0325+44	out.

23. Unfortunately the evidence of the Captain and the First Officer as to what happened during the final talk-down does not agree.

Capt. Stewart's account in evidence was that he became visual when he was approximately a quarter of a mile short of the most easterly approach lights, which would

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place the aircraft approximately three quarters of a mile from the threshold or half a mile from the point where the talk-down was completed. The Captain stated that he could then see all the approach lights and all the runway lights. He was able to estimate his height from the ground visually and by reference to his altimeter which he reckoned to be 700 feet.

During the final stage of the approach he was flying port wing low to counteract the cross wind. All the appropriate checks were carried out including the extension of the flaps to 25 and then 30 degrees. The landing lights were checked during the approach prior to the outer marker beacon. There was a slight drizzle which caused him to put on the wind shield wipers.

Just as the aircraft was coming over the most easterly approach light, Capt. Stewart gave an order to the First Officer—"Landing Flaps, Full Flap; Landing Lights On." He says that from the feel of the aircraft in his hands he is certain that the flaps had been extended to the 45 degrees position, but that no acknowledgment of this order was given by the First Officer. The landing lights were not illuminated and he again asked the First Officer for the landing lights to be put on. According to the Captain the First Officer replied "They are on."

Capt. Stewart says he was misled into thinking that the landing lights were in fact on by the glare of the approach lights. All the eye witnesses, except one who was undoubtedly mistaken, agree that the landing lights were never illuminated during the final approach.

According to Capt. Stewart the final manifold power setting was 20 inches or 25 inches. Up to the time of the completion of the talk-down he experienced nothing unusual. The aircraft had behaved normally and he made no complaint of the talk-down.

He then describes what happened next in these graphic words—"I was slightly high on the glide path, I steepened my approach and when I reached the altitude that I wanted to soften my rate of descent I eased the control column back. The aircraft responded inasmuch as it changed altitude. Then it seemed to fall out of my hands. Visibility deteriorated to the extent that the lights were then visual as if seen through haze. We came out of that condition and hit the ground, I think port wheel first and it probably took much less time to happen than it has taken me to tell you."

His steep descent was necessitated because he was high relative to his aiming point which was 200 to 300 yards up the runway. His speed was 130-135 knots until full flap was selected, then a decrease from 130 knots to cross over the threshold at 115 knots. His stated intention was to cross the threshold at a height of about 3 to 5 feet from the ground.

24. First Officer King's evidence tallies with the Captain's evidence up to the beginning of the final approach. Thereafter it differs to some extent. He agrees that they became visual at about 700 feet and that the Captain ordered full flap before the approach lights. This order he acknowledged. The First Officer executed this order by operating the flap selector switch until

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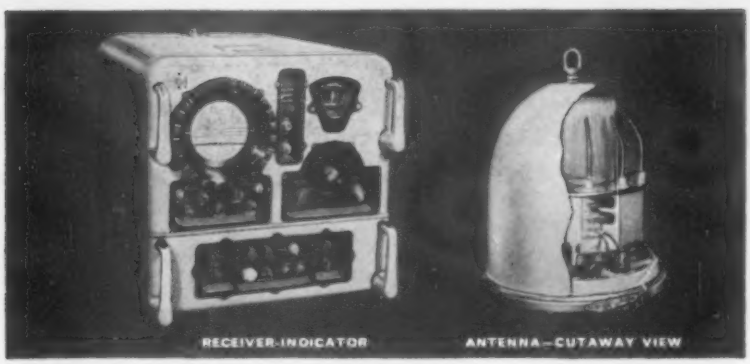

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the instrument on the panel showed 45 degrees. When the indicator had gone to 45 degrees he said to the Captain "You have Full Flap."

He stated that he received no order from the Captain for landing lights on during the final approach and accordingly did not apply the landing light switches and the landing lights were never illuminated. He had the impression that the aircraft was high for an approach and that the descent was fairly steep. His recollection is that the aircraft was in cloud for a few seconds. He obtained no impression of the aircraft sinking except in the last split second before the aircraft hit the ground.

25. The remainder of the crew gave no assistance on the conflict between the Captain and the First Officer. No one overheard the orders given by the Captain on the final approach. Flight Engineer Wilson, who was at the panel as engineer for the approach and landing, says that the power settings ordered were 37½ inches, 28 inches and 25 inches all at an engine speed of 2120 rpm. These were, according to the witness, perfectly normal settings for an approach to Prestwick.

26. A number of eye-witnesses on the ground gave evidence as to the behaviour of the aircraft before and at the time of the crash.

The most valuable evidence came from the Approach Controller who witnessed the approach of the aircraft and the accident through a pair of binoculars from the control tower.

He observed the navigation lights when the aircraft passed the range of one mile from touchdown. The landing lights were never on.

According to him, the aircraft appeared rather high and when it was about three quarters of a mile from touchdown it descended more rapidly than is normal. During the approach of the aircraft he was able to see all the runway lights, the threshold lights and all the approach lights except one which was obscured by the configuration of the ground.

GROUND DAMAGE AND AIRCRAFT DAMAGE

27. The aircraft struck the ground nose wheel first. Almost immediately thereafter the port landing wheels contacted the ground at a distance of 127 feet from the threshold; the starboard wheels first contacted the ground 70 feet from the threshold.

The marks indicated that the aircraft had made a fairly straight approach to the runway being only 12 feet to the right of the centre line. The port main landing wheels continued their marks for a distance along the runway when the aircraft again became airborne for a distance of 373 feet. The second impact probably caused the collapse of the port main landing gear and thereafter the aircraft skidded along the runway for about 1,200 feet to its final position. Following the collapse of the port undercarriage the port wing folded back and trailed beside the fuselage.

Various portions of the aircraft were shed during its course along the runway and No. 4 engine was completely detached during the final break-up on the south side of the runway. A severe structural

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failure occurred in the area of the wing root and the aircraft lay with the crew compartment on its port side and the main fuselage in an inverted position and resting on its tail fin. The port wing was partially covered by the fuselage.

28. A careful and minute examination was made of all parts of the aircraft after the accident. The position of the flap mechanism indicated that the flaps at the final point of rest were at the 35 degrees setting.

The left elevator compensator trim tab was at a setting which would be commensurate with the flap setting at 35 degrees.

The torque bar which operates the flaps was fractured; the wing flap indicator was found, but it was so badly damaged that no setting could be determined.

The wing flap and landing lamp control panel was also recovered, but this had been so destroyed by fire that it was impossible to make any safe deduction as to the position of the switches at impact or final rest.

The left landing light was in the fully extended position.

The rear spar of the port wing was fractured, but it was impossible to say whether this fracture occurred at first or second impact.

When the rear spar fractured it is possible that the torque tube which operates the flap mechanism became out of alignment and this, if it occurred, would have prevented the flaps from operating further in either direction.

29. Various possibilities were canvassed as to the likelihood of the flap mechanism operating after the first impact. There is a remote possibility that the flap mechanism operated after the first impact either by the relay making a connection or the switch being moved in the course of the crash, but the Court considered that the strong probability is that the flaps were in the 35 degrees setting at the moment of first impact and never moved from that position after.

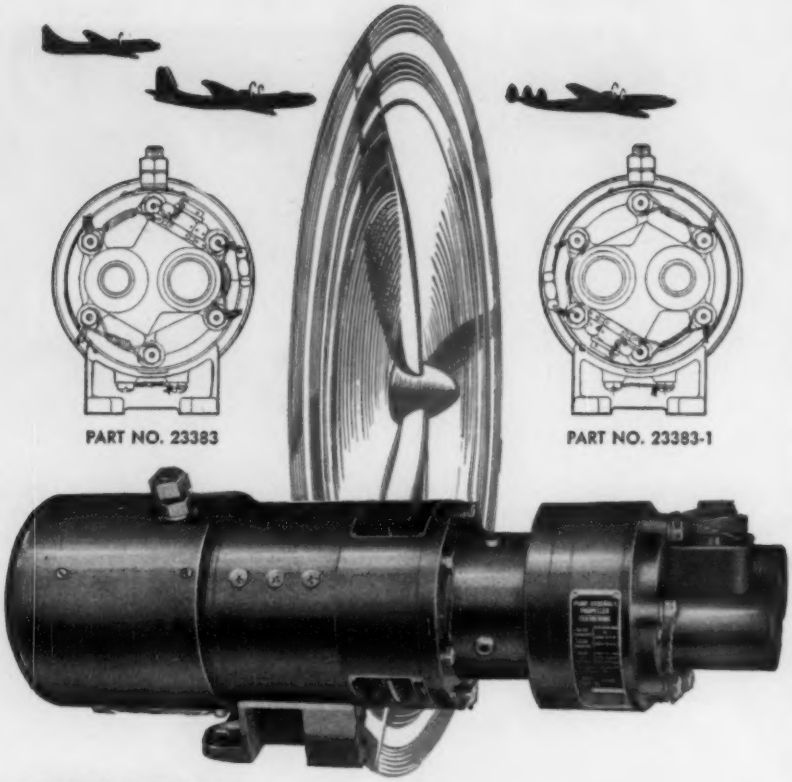
30. The marks on the ground and the damage to the aircraft indicate that at the time of hitting the ground the port wing was low to the extent of about 5 degrees to the horizontal.

POSSIBLE CAUSES OF THE ACCIDENT

31. Having regard to the evidence of the talk-down, the ground damage, and the damage to the aircraft, it is possible to obtain a fairly accurate picture of what happened up to within a few seconds of the aircraft hitting the ground and after the aircraft hit the ground. The important gap lies in the few seconds which elapsed after the talk-down was completed.

Capt. Stewart's explanation of the accident is that the flaps must have retracted from 45 degrees to 35 degrees during the last five seconds or so prior to the crash and that this caused the aircraft to sink and so hit the ground. In considering this explanation it is necessary first of all, if possible, to resolve the conflict between the evidence of the Captain and First Officer as to the landing lights.

We have no doubt that Capt. Stewart gave the order to switch on the landing



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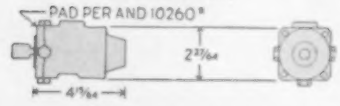

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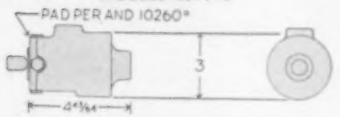

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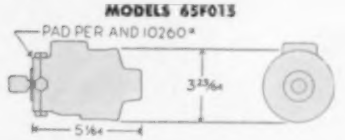

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Weight: 4.0 lb.

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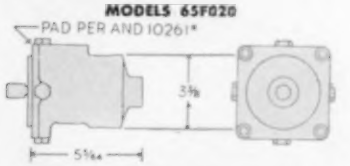

Rated Capacity: 2.0 gpm @ 1500 rpm.
Max. Continuous Speed: 7500 rpm.
Continuous Pressures: 1500 psi and 3000 psi.
Weight: 5.5 lb.

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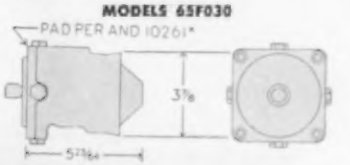
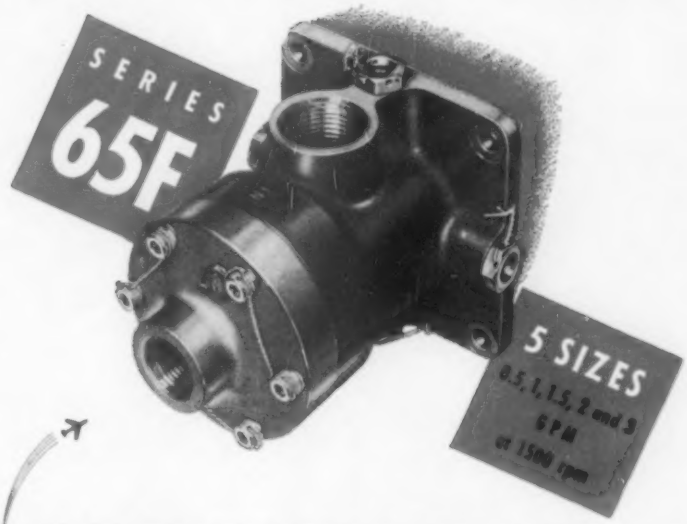


Rated Capacity: 3.0 gpm @ 1500 rpm.
Max. Continuous Speed: 7500 rpm.
Continuous Pressures: 1500 psi and 3000 psi.
Weight: 6.0 lb.

***Other mounting flanges and port arrangements available.**



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lights and that this order was not carried out by the First Officer and that the landing lights were accordingly not illuminated during the final approach. The order for flaps and the order for landing lights should, wherever possible, be separately given and separately acknowledged. However this may be, it is not possible to explain First Officer King's failure to put on the landing lights by the confusion of the double order, because Capt. Stewart, if he is to be believed and on this matter we are prepared to accept his evidence, reiterated the order for landing lights.

We find it difficult to understand how Capt. Stewart could have been misled into thinking that the landing lights were on from the glare of the approach lights, but it is possible that the low cloud on the approach path led him into this mistake.

We feel that if the order for landing lights had been given earlier and had been carried out the flight of the aircraft into low cloud might have been avoided. The advantage of giving the order for landing lights at an earlier stage is that if the order is not carried out or if the lights do not go on, there is time for the pilot to reconsider his position.

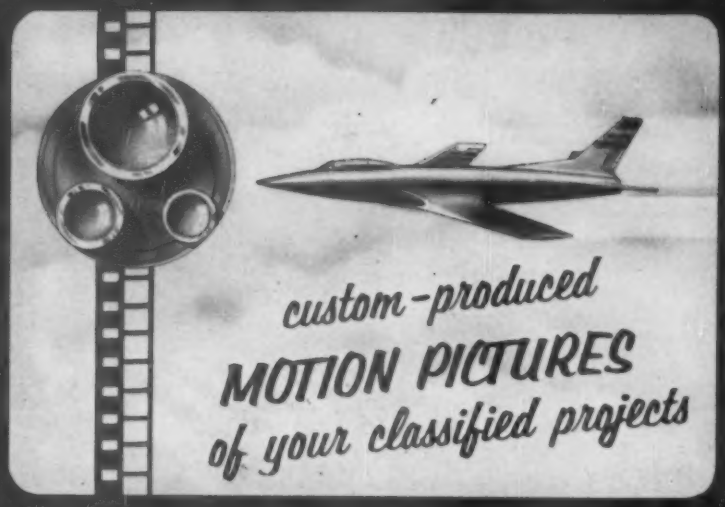
The next point worthy of consideration is if the flaps retracted from 45 degrees to 35 degrees, how this took place. We dismiss the suggestion that the flaps were never extended to 45 degrees for the reason that there is no evidence to support it.

It is clear that the flaps could only retract by the operation of the flap selector switch. This is on the instrument panel next to the landing light switches immediately adjacent to the First Officer's seat. The flap selector switch is guarded on either side by a projection of metal. To operate the flaps to the down position the switch is moved in a forward motion. The switch, being spring loaded from this position, returns automatically when released to the neutral position which is vertical. To retract the flaps the switch is moved aft and on this side the switch is not spring loaded and only returns to the neutral position on being moved to the vertical.

Prior to the accident, on a training flight, a pilot had the experience of the flap selector switch on the final approach springing into the retract position after full flap had been selected and the switch released. This caused BOAC to issue a warning to Captains and First Officers, to ensure that the flap selector switch is returned to the "off" position at all times. Since the accident, three other BOAC pilots have reported similar malfunctioning of the flap selector switches which occurred prior to the accident.

We do not consider that this malfunctioning of the flap selector switch was due to any mechanical defect in the system. The flap selector switch operated correctly if it was handled with care.

First Officer King testified that he did not allow the switch to move to the retract position and in fact asserted that he kept his fingers on the switch until he returned it to the "off" position. There is a further possibility that First Officer King in a last second attempt to switch on the landing lights in response to Capt. Stewart's reiterated order for them inadvertently operated the flap switch. First Officer King



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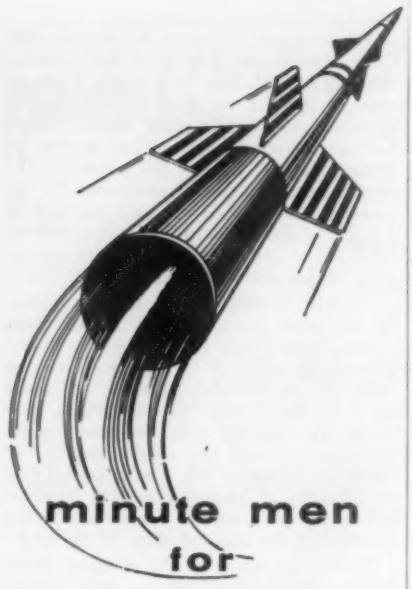

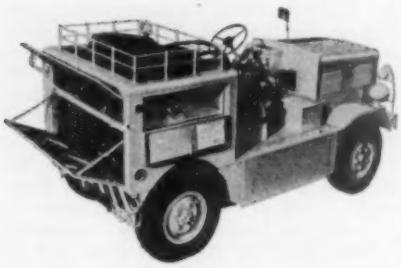

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denies this and we think it is improbable in view of the different position, structure and movement of the two switches.

Assuming, however, that the flaps retracted from 45 degrees to 35 degrees the next question is what caused them to retract. The possibility of the flaps retracting between first and second impact was canvassed but having regard to the damage and to the rate of retraction of 2 degrees per second we rejected this possibility.

We think that contrary to First Officer King's evidence the most probable explanation is that when operating the flap selector switch he allowed the switch to spring back from the extended position past the "off" position and that the strength of the spring did, as it had done on the other occasions, move the switch into the retract position which caused the flaps to move from 45 degrees to 35 degrees.

If this did take place, the mechanism must at some point prior to the aircraft coming to rest have stopped retracting. We consider that the probability is that this occurred with first impact when the rear spar was fractured and the torque tube put out of alignment.

32. The next step in considering what came to be known as the "flap theory" is whether this caused or contributed to the accident.

On Capt. Stewart's account nothing unusual occurred until the last few seconds before impact. The question is therefore whether the flap retraction from 45 degrees to 35 degrees could have caused the sink which Capt. Stewart sensed and resulted in the aircraft "falling out of his hands" as he described it.

Tests were made in the air on a Stratocruiser by a BOAC pilot after the accident as to the effect of a flap retraction from 45 degrees to 35 degrees at varying speeds. The results of these tests, which were not controlled, were indeterminate and we did not find ourselves assisted by them.

More valuable assistance came from Capt. Brooke Harper, Test Pilot of Boeing Airplane Co. He produced a report from his company made in response to questions asked by BOAC in relation to this accident. This report was not prepared by Capt. Harper, but by other officials of the company who were not adduced as witnesses. We accordingly only rely on those parts of the report which coincided with Capt. Harper's views.

Graphs were produced which showed that the stalling speeds of this aircraft with flaps at 45 degrees and 35 degrees were very close. The evidence shows that this aircraft at no time prior to the accident approached these speeds. Graphs also showed that the lift coefficient was not materially affected by the retraction of the flaps from 45 degrees to 35 degrees and that a retraction of the flaps from 45 degrees to 35 degrees would only require an increase of 2 degrees in the angle of attack to compensate for this retraction. The retraction of the flaps which would be at a rate of approximately 2 degrees per second would be gradual and the change is partially compensated by the left compensator trim tab which works in conjunction with the flap retraction gear.

Capt. Harper's view was that the difference in handling characteristics of the aircraft caused by the retraction of the flaps from 45 degrees to 35 degrees was one which a careful pilot should be able to cope with.

33. After a close and careful study of the evidence and after considering the advice of my Assessors, I reached the conclusion that the retraction of the flaps from 45 degrees to 35 degrees did not cause or contribute to the accident.

34. Assuming that the retraction of the flaps was not associated with the accident, it becomes necessary to consider what was the cause of the aircraft hitting the ground 127 feet short of the threshold.

In approaching this branch of this case we have perforce to discard Capt. Stewart's evidence as to what happened during the last few seconds before impact. We can express our views on this matter shortly. Capt. Stewart's approach was, on his own admission high, and from the talk-down record, we consider, unduly high.

In order to touch down in the position and at the point which he was aiming at it was necessary for him to make a steep final descent. The rate of descent has been calculated accordingly to a profile prepared in relation to the talk-down at 1,260 feet per minute in the last 10 seconds before completion of the talk-down. This compares with a steady descent by the Captain of Uncle Peter of 636 feet per minute.

At what stage the aircraft went into reduced visibility due to cloud it is impossible to state with precise accuracy. It was probably, according to First Officer King's evidence, in these conditions for a longer period than Capt. Stewart stated. We consider that the Captain owing to the reduced visibility into which the aircraft passed and the lack of landing lights, flared out too late and too severely, thereby causing the aircraft to sink too rapidly during the last few seconds. Flap retraction may have played a minimal part in the final sink, but in our opinion owing to the Captain's errors of judgment, the aircraft would, in any event, have hit the ground at about that point apart from any question of retraction of flaps.

35. Capt. Stewart reported to the Meteorological Office at London Airport at 1520 hours on 24th Dec., 1954, having telephoned for information about the weather at 1400 hours. First Officer King had reported about noon on the same day. The flight of Sugar Charlie had been scheduled to leave London at 1745 hours, but owing to a delay in waiting for a passenger to be flown from Manchester, Sugar Charlie did not become airborne till 2158 hours.

In the course of the flight the port undercarriage failed to retract and fuel had to be jettisoned prior to making a landing at 2245 hours. The takeoff of Sugar Able from London Airport took place at 0120 hours and the accident happened at Prestwick about 0325 hours on 25th December. Capt. Stewart had accordingly been on duty for about 12 hours and First Officer King for a slightly longer period. These members of the crew had undoubtedly had a long and tiring day and Capt. Stewart had throughout anxieties about the weather to be encountered at Prestwick and indeed had considered the possibility of several alternate airports for landing. His actual flying time

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was however approximately three hours.

While I am prepared to believe that Capt. Stewart would by 0320 hours on the morning of 25th Dec. be fatigued, I do not consider that he was so unduly fatigued as to endanger the safety of the aircraft. Capt. Stewart himself disclaimed any feeling of tiredness at the time of the accident. On this matter I was guided very much by my Assessors who advised me that the tour of duty of Capt. Stewart and First Officer King would not be such in their opinion as to induce undue fatigue.

36. The Regulations of BOAC provide no maximum period of duty for members of the aicraft crew. It is left to the discretion of the Captain to call for a standby crew. In our opinion consideration should be given by BOAC to Regulations providing for on-duty time limitations prior to departure from the airport and in the course of the flight. We were informed that the Ministry of Transport & Civil Aviation had at present under consideration the question of the tours of duty by air crews.

37. At the time of the accident there was an ILS localizer—but no glide path—and GCA system in operation on Runway 31. Difficulty had been experienced in setting up the ILS with glide path on Runway 13 and the operators were not agreed as to whether Runway 13 or Runway 31 should have priority in relation to the provision of the only ILS with glide path available at Prestwick.

We have no doubt that the ideal to be aimed at is a complete ILS on both Runways 13 and 31. Conditions, however, at Prestwick did not, in our view, necessitate the installation of ILS with glide path as a matter of urgency on Runway 31. In addition to the GCA system there was the radio range system which can be used as an approach aid for a descent through cloud. Further assistance was obtained from the Inner and Outer Marker Beacons.

We do, however, recommend that a complete ILS should be installed on either Runway 13 or 31, whichever requires it most, and this should be kept continuously in operation.

38. As has already been mentioned, Sugar Able was preceded by Uncle Peter on the approach to Prestwick. The Captain of this aircraft was offered and accepted GCA and with its assistance he made a normal safe landing. After the accident to Sugar Able he went specially to the Tower and complimented the staff on the assistance he had obtained from GCA. Capt. Stewart himself made no complaint of the GCA system and indeed the behaviour of the aircraft only became abnormal after the talk-down was completed.

39. At 1600 hours on 25th Dec., in accordance with practice, a post-accident flight check was made of the GCA system and it was found to be out of the tolerance limits laid down by the Ministry of Transport and Civil Aviation.

The glide path error at two miles was some 90 feet, i.e. the actual glide path was 90 feet below the true glide path. This error would reduce as the glide path approached the threshold and at 400 yards it probably would be no more than 10 feet.

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laid down by the International Civil Aviation Organization. The glide path was, on

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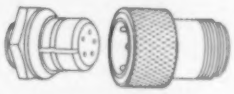

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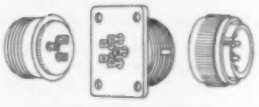

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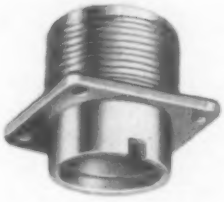

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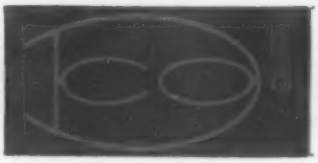

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"Inside Marvin Miles"

Marvin Miles is 44 years old, 5'9½" tall, weighs 160 lbs., and has a personality once described as mildly pixilated. He dresses conservatively, carries a small battered notebook, and sports a "butch" haircut which camouflages a hairline considerably higher than the above picture indicates.

Professionally, Miles is Aviation Editor of the Los Angeles Times. His contributions to the Times are principally "Skyways," a Sunday column regarded as gospel by the Southern California Aviation industry and frequent page 1 feature stories about, say, his supersonic flight (in an F-94) or, perhaps, an aerial voyage in a Curtiss Jenny maintained by a local sportsman. Following these stories, the reader gradually realizes that Marvin is either completely innocent of any feeling of fear, or that certain portions of his caution circuits are disconnected. His escapades include an altitude record (for newsmen), atom blasts, altitude chambers, cold chambers, hot chambers, glider flights, and, as he might say, myriads of similar adventures. He has witnessed many tragic accidents and occasionally chalks up a near miss or two himself.

His acquaintances include generals, admirals, mechanics, industrial executives, politicians, and a prominent downtown panhandler. He travels frequently to the far corners of the world ... usually by luxury airliner. He also travels by ship, military aircraft, experimental aircraft, and recently, by a General Patton tank across the Nevada desert near Yucca Flat. An attempt to contact Marv by phone at his office may uncover the startling information that he is in Tokyo today and can be reached tomorrow in Manila (this usually occurs when a Valve Talk manuscript is about two weeks overdue).

In the course of reporting aviation news he has repeatedly distinguished himself as an investigator. By surmise and deduction he regularly discloses information of the type that brings the cloak and dagger boys by the carload. Since his stories are always based upon known information, however, he replies in print whenever he feels his case is justified. On these occasions we offer to send him cigarettes if he is put in residence at some Federal pokey.

Marv lives in La Canada in the Verdugo foothills. His family ... who would like to be better acquainted with this traveler ... are Betty, his wife, and Marilyn, 20, Melanie, 15, and Mark, 10.

His hobbies include swimming in his hillside pool and pencil and charcoal drawing. He belongs to the American Institute of Journalists and Aviation Writers Associations, Los Angeles Press Club, and Alpha Eta Rho, the national aviation fraternity.

He graduated from the University of Southern California in the Class of '33, and has been with the Los Angeles Times for twenty years. Always interested in flying, he never found time to become a pilot himself.

Whittaker asked Marvin to write Valve Talk with the specific understanding that he could write as he pleased upon subjects of his choice. Characteristically, he repeatedly stirs up controversies. But we have enjoyed it all, and we know from your letters that you, the readers, have shared our enthusiasm for Valve Talk and its author. Hope you enjoyed meeting him this way ... a wonderful guy to know.

laid down by the International Civil Aviation Organization. The glide path was, on 25th Dec., only slightly out of the ICAO limits of tolerance. Further tests were made on 26th Dec. and after adjustments made by the ground staff the system was still out of tolerance on 27th Dec. and it was then pronounced unserviceable. The assistance of the Maintenance Unit of the Telecommunications Section of the Ministry was called for and after further flight checks the system was pronounced serviceable on 31st Dec.

The precise cause of the error was never actually discovered, but there is reason to believe that owing to the undue sensitiveness of the apparatus, flight checking cannot always be relied upon to test the glide path with absolute accuracy. It is not possible accurately to test a machine of the utmost sensitivity by use of a testing apparatus which, in its very nature, is less sensitive.

It is gratifying to learn however that a new and improved system of flight checking by photography is being tried out and will, it is hoped, in due time be completed. This will eliminate the possible errors in the present system of flight checking.

40. Whatever be the causes of the error in the glide path, this was not serious at the time of the accident and did not in our view in any way contribute to it. The GCA was flight checked by the Ministry of Transport and Civil Aviation officials on 22nd Nov. 1954. Thereafter it was successfully utilized without complaint by numerous aircraft.

The accident occurred after the talk-down had been completed and when the Captain was visual. Any error in the glide path did not cause any danger from the obstacle clearance point of view.

In our opinion the attacks made in the course of the Inquiry on the GCA system and the staff engaged in operating it were wholly unjustified. Nothing which transpired at the Inquiry need, in our judgment, cause any apprehension on the part of the public or airline operators as to the GCA system which is operated internationally and relied upon universally. Indeed it would be the greatest disservice to the system and to air travel in general if some of the random assertions made at the Inquiry in relation to the GCA system were given any credance whatever.

41. While there was in our opinion no criticism which could be fairly levelled at the operation of the GCA system on the night of the accident, the result of the evidence was to show some lack of integration and cooperation between certain branches of the Telecommunications Section of the Ministry. These matters should be enquired into carefully with particular reference to the periodicity of flight checks.

The aim should be that the intervals should be set down as a practicable and attainable target. Once periodicity has been fixed, every effort should be made to keep to schedule.

42. These functioned efficiently and promptly. The aerodrome services were in operation and assistance was obtained from local Fire Brigades. Doctors and ambulances were on the scene promptly and the

services of Ministers and Priests were readily available. The Airport Police were supple-

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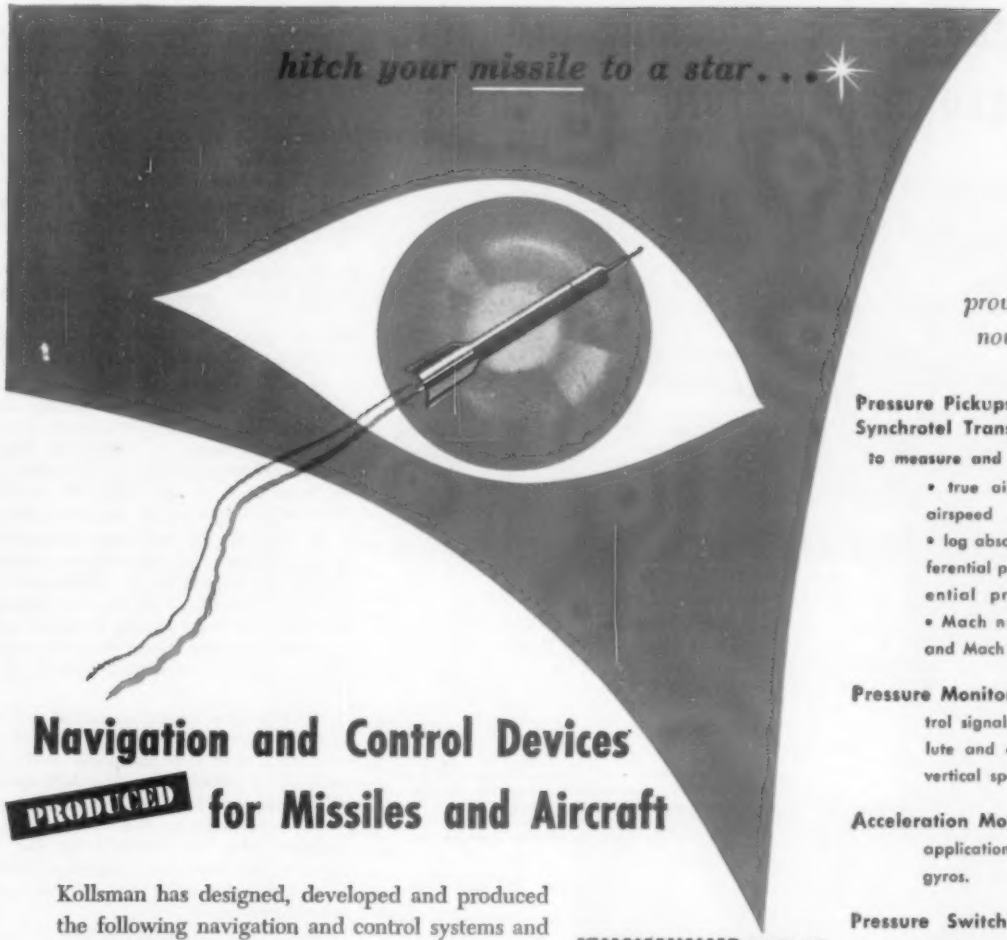

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CLASSIFIED **Computing Systems** to provide precise data for automatic navigation and guidance, operated by optical, electromechanical, and pressure sensing components.

FOR CONTROL

proven components now in production

Pressure Pickups and Synchrotel Transmitters to measure and electrically transmit • true airspeed • indicated airspeed • absolute pressure • log absolute pressure • differential pressure • log differential pressure • altitude • Mach number • airspeed and Mach number.

Pressure Monitors — to provide control signals for altitude, absolute and differential pressure, vertical speed, etc.

Acceleration Monitors — for many applications now served by gyros.

Pressure Switches — actuated by static pressure, differential pressure, rate of change of static pressure, rate of climb or descent, etc.

Motors — miniature, special purpose, including new designs with integral gear heads.

SPECIAL TEST EQUIPMENT optical and electromechanical for flight test observations.

Please write us concerning your specific requirements in the field of missile or aircraft control and guidance. Technical bulletins are available on most of the devices mentioned.

kollsman INSTRUMENT CORPORATION

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From Wyandotte . . . cleaning products that speed manufacture, cut costs

This is Wyandotte's newest addition to its vast production facilities . . . the Los Nietos Plant in Calif. It is one of the largest plants on the Pacific Coast devoted to producing specialized cleaning materials. Here—and at plants in Wyandotte, Mich.—a special group of products are made for the aircraft industry.

	YOUR PROBLEM	ANSWER	DESCRIPTION
1	Aluminum cleaning	Altrex*	All-purpose, non-etching soak-tank cleaner; removes marking inks and soil.
2	Deoxidizing aluminum prior to spot welding	2487	Room-temperature deoxidizer: reduces contact resistance of aluminum alloys.
3	Magnesium cleaning	W.L.G.*	Heavy-duty soak cleaner for magnesium, steel, copper, and brass.
4	Removing heat-treat scale from stainless steel; brightening heat-treated aluminum	MF Acid	Replaces dangerous hydrofluoric acid; easier and safer to handle and use; less corrosive.
5	Paint-booth coating	Hedral	Protective coating. Cuts labor costs, simplifies booth upkeep. Brush or spray on.
6	Waterwash paint-booth compound	Flote†	Very small amounts required; kills zinc chromate primer, floats air-dry lacquers.
7	Electrocleaning	F.S.*	Heavy-duty electrocleaner for cleaning steel before plating. Exceptional detergency.
8	Barrel finishing	Burnek	Add to water in barrel finishing for brighter metal finishes. Removes light tarnish.
9	Floor absorbent (anti-slip)	Zorball	An all-purpose floor absorbent; makes floors skidproof, safe at lowest use-cost.

*Reg. U.S. Pat. Off. †Patent Applied For

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AIRCRAFT DEPARTMENT 2320 • Wyandotte, Michigan

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services of Ministers and Priests were readily available. The Airport Police were supplemented by the Civil Police. So fierce was the fire that it was not finally extinguished till 0800 hours on 25th Dec.

There was close and integrated cooperation between all the Services and full cooperation and assistance was obtained from the United States Air Force Services.

43. Sugar Able was marked externally to show where access to the aircraft was easiest. While these marks would be of assistance to those engaged in Rescue Service, it would be of further assistance if some plainly marked instructions were given on the outside of the aircraft doors in order to show how these could easily be opened.

44. A suggestion was also made that a system of battery-operated lighting should be installed on transport aircraft in order that in the event of failure of electrical power, passengers would be able in the event of an accident to see their way to safety. We entirely approve of this suggestion.

45. The aircraft had been maintained in good condition and was properly equipped, fuelled and loaded for its flight from London to Prestwick. The engines functioned normally and there was no reason to believe that there was any failure of the equipment. There was no mechanical defect in the aircraft.

46. The crew were experienced and competent. Capt. Stewart was a pilot of great experience who had familiarity with Prestwick. First Officer King also had considerable experience in the position of co-pilot.

Although nothing was disclosed in the evidence, the conclusion from the temperament of these two individuals may be that there was some lack of cooperation between them.

There was nothing in the tour of duty to cause undue fatigue. BOAC should consider some limitation of the hours of duty of an air crew at an airport.

47. The flight proceeded normally up to the point where the GCA talk-down began. The GCA system worked normally and correctly. Any error in the glide path was minimal and had nothing to do with the accident.

48. Capt. Stewart's orders to put on the landing lights were not carried out by First Officer King. The landing lights would have enabled the Captain to observe earlier the presence of low cloud into which the aircraft passed immediately prior to striking the ground.

49. Weather conditions were such that the Captain's decision to land was correct. The weather minima of BOAC on Runway 31 at Preswick are adequate to ensure the safe operation of aircraft.

50. Capt. Stewart kept the aircraft unduly high on the final approach. His descent to the runway was abnormally steep and in order to correct his steep descent his flare out was too late and too severe. The aircraft passed through low cloud over the approach lights and owing to the absence of landing lights the reduced visibility took the Captain by surprise and in the last few seconds he failed to appreciate how near to the ground he was.

51. The lighting at Preswick was adequate, although this will be considerably improved when the Calvert Crossbar System of lighting is installed.

• SAFETY

Checked at every step...

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airborne equipment is right!

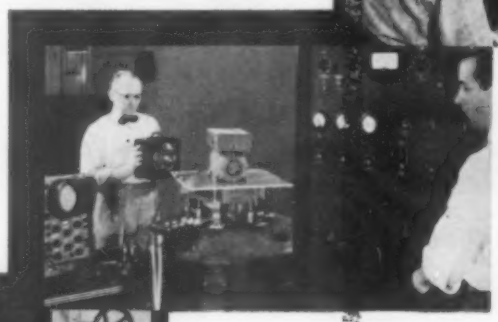
Every piece of airborne electrical equipment that leaves the Leland plant is right and *we know it's right.* Because we've proved it at every stage of its development and manufacture.

Prototype models are tested for performance under extreme conditions of *high- and low-frequency vibration, shock, altitude, temperature, salt spray and humidity...* scientifically checked for *RF noise, dynamic balance...* proved in every possible way with the most modern, most accurate testing equipment.

And throughout production, every unit is subjected to this same kind of thorough, conscientious testing to make absolutely certain that the unit you receive meets Leland's *own* highly critical standards.

These complete testing facilities and procedures give you still further assurance that Leland is capable of solving *your* aircraft electrical problem, whether it involves inverters, alternators, generators, or motors.

Why not get in touch with us.



(Ascending)
Prototype assembly shop readies designs for testing. Altitude Chamber duplicates stratospheric conditions. Vibration Test challenges design. Assembly Line Inspection Stations constantly check quality.

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● SAFETY

52. The GCA system functioned correctly and the facilities provided gave reasonable and safe assistance to the aircraft. An effort should be made to institute complete ILS with glide path on either Runway 31 or 13 without further delay, if this has not already been done. The working of the Telecommunications Section of the Ministry should be looked into.

53. Improved marking of points of access to an aircraft should be introduced and battery operated emergency lighting to supplement the normal system should be made obligatory.

The questions submitted by the Lord Advocate and the Court's answers to them are as follows:—

1. Who was the registered owner and operator of aircraft G-ALSA on 25th Dec., 1954?

British Overseas Airways Corp.

2. Did the aircraft have a valid Certificate of Airworthiness and a current Certificate of Maintenance at the commencement of the flight?

Yes.

3. Was the aircraft correctly loaded?

Yes.

4. Were the Captain and operating Crew properly licenced and the Captain adequately experienced to make the flight?

Yes.

5. Were the whole circumstances attending the tour of duty of the aircraft crew likely to introduce undue fatigue?

No.

6. Did the Ground Control Approach equipment function correctly during the approach to land of the aircraft?

Yes.

7. Were the facilities such as to give reasonable assistance from the ground to the aircraft?

Yes.

8. Did the weather conditions cause or contribute to the accident?

The weather conditions contributed to the accident.

9. Were the minima of the BOAC adequate to ensure the safe operation of the aircraft?

Yes.

10. Was the Captain's decision to land a correct one?

Yes.

11. What was the cause of the accident?

Errors of judgment on the part of the Captain in (a) starting his final approach to land at too steep an angle and (b) flaring out too late and too severely with the result that the aircraft sank and hit the ground short of the runway. During the flareout the aircraft passed through low cloud, thus reducing the Captain's visibility. The accident was also contributed to by the failure of the First Officer to carry out the order of the Captain to put on the landing lights, which prevented the Captain from observing timeously the low cloud over the approach lights.

12. Was the accident caused or contributed to (a) by the wrongful act or default of any person or party and/or by (b) by any mechanical defect in the aircraft?

No.

13. Did the fire fighting and rescue service function satisfactorily?

Yes.

(Signed) C. W. Graham Guest, Edwin D. Avary, I. C. Grant.

Simmonds

SU FUEL INJECTION SYSTEMS

Proven in Operation to Offer . . .

MAJOR FUEL ECONOMIES • INCREASED POWER OUTPUT

Simmonds Aerocessories, Inc., manufactures the only advanced type fuel injection system now in production in the U.S. for reciprocating engines up to 600 h.p. After extensive field tests on U.S. ordnance engines (where fuel economies of more than 20% were proven) SU Fuel Injection Systems are also being specified on a growing list of medium-range aircraft and helicopter engines.

Other proven advantages of the SU Fuel Injection System:

- **Overcomes major icing problems; gives improved cold starts.**
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- **Provides increased power output due to removal of intake obstructions.**
- **Provides improved fuel distribution and better cylinder head cooling.**
- **Operation not affected by engine attitude.**

Complete data on SU Fuel Injection Systems available on request.

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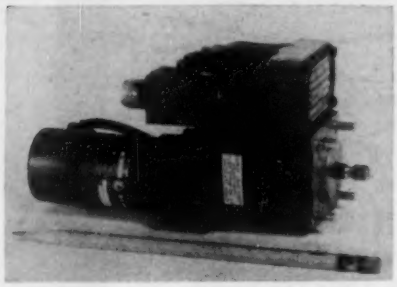
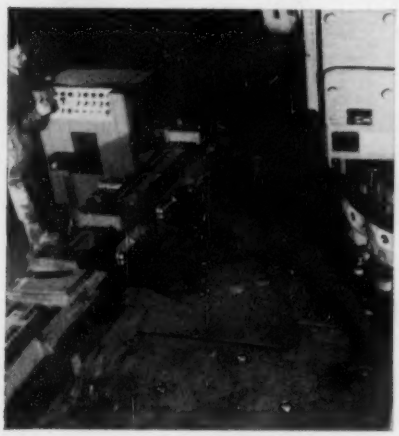
NEW AVIATION PRODUCTS



Actuator For C-130 Louvres

M-7370 rotary actuator for nacelle vent louvres on Lockheed C-130 weighs 2.1 lb. and has an operating torque of 50 in.-lb. at 2.5 rpm. Actuator, with reported operating temperature range of from −65 deg. to +250 deg., is powered by an enclosed-type 1,500 frame size, series wound, 26 volt d.c. reversible motor. Life span exceeds 10,000 cycles at room temperature.

Air Associates, Aircraft Products Division, Teterboro, N. J.



Punch Cards Control Machines

Numerical positioning control uses standard punched business machine cards to direct and control machine tools. It is adaptable for riveting, placement, milling, boring and drilling machines, punch presses, lathes and shears. Manufacturer reports it can double or triple tool machine productivity.

General Electric Co., Specialty Control Department, Waynesboro, Va.

Fast Single-Spindle Automatic

Screwmatic 750 single-spindle automatic has demonstrated its ability to deep-hole drill, tap, finish form and knurl a complex part in one feed-out in 28 sec., the maker states.

Machine has this capability, the manufacturer notes, because the turret unit has 6¾-in. adjustable distance between turret and check, three electronically controlled infinitely variable speeds, rugged built-in vertical slide, air-powered feeding mechanism and a spindle and drive designed to take no belt load on the bearings.

Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

New Machines to be Shown

Among new production machines to be displayed at the Machine Tool Show in Chicago's International Amphitheatre Sept. 6-17 are:

Landis

• **Type K 10-in. plain cylindrical grinder** with a 30-deg. angle wheel head allows simultaneous shoulder and normal cylindrical grinding. When required, multiple diameters and shoulders can be ground at the same time. Work speeds are from 54-200 rpm.

• **Three different grinders** tied together in an automated line will demonstrate ball bearing races production at the show.

Workpieces are placed in a vibrating-type hopper and transported to the first machine, a Gardner 2H30-26-in. precision horizontal double disk grinder. Here parallel sides of the rings will be ground to size automatically at the rate of 6,000 hourly. Parts are then delivered to the Landis No. 12½ centerless grinder, where outside diameters are ground in multiples of 10 parts per loading cycle. Process is called stack grinding.

After ejection from this process, the items go through a Sheffield air gage and are then moved to a Bryant 2209-G automatic internal grinder. Race diameter grinding is controled by diamond sizing. As a production aid, the machine is cycled to dress only at intervals instead of for each work part.

• **Built-in feedback gaging** and automated handling equipment incorporated in a Landis 4-in. concentric grinder will be shown in action with inner bearing races ground at the rate of 250/hr. to a tolerance of 0.0005-in. on diameter. Stock removal will be 0.016-in.

A process controller will feed all sizing data back into the machine for adjustments necessary to produce correct part size.

Landis Tool Co., Waynesboro, Pa.

Potter & Johnston

• **Model 6-DRE-40 automatic turret lathe** has a headstock capable of 40-hp. input to provide the extra power needed to permit full use of carbide tooling for fast metal removal on tough alloys. Chuck sizes are 18, 24 and 30 in. Speed range is from 23 to 470 rpm.

Potter & Johnston Co., Pawtucket, R. I.

South Bend Lathe

• **Precision vertical milling machine** takes 90x58 in. of floor space with 78-in. height. Table is 9 in. wide and is available in 32-in. or 42-in. length with 20-in. or 30-in. longitudinal travel, 9.5-in. cross-feed and 18-in. vertical feed. Universal head swivels 360 deg. for milling, boring or drilling at any angle.

• **13-in. precision turret lathe** has maximum swing over bed of 13⅛ in; over double tool cross-slide, 3 7/16 in. Maximum capacity through spindle is 1⅜ in. and maximum collet capacity is 1 in. round. Universal carriage has a friction clutch for 48 power longitudinal feeds ranging from 0.0015 in. to 0.0841 in., also lead screw and split nut for cutting 48 pitches of screw threads from 4 to 224 in.

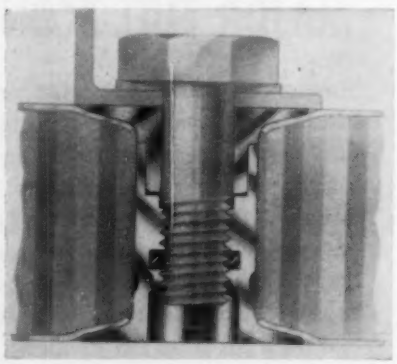
South Bend Lathe Works, South Bend, Ind.

Control Panel for Borers

A hydraulic control panel, applicable to all hydraulically operated precision borers, including standard and way types, is said to provide faster rapid traverse and a snubbing action for smooth deceleration from rapid traverse to feed or stop.

The panel also permits higher feed rates for machining aluminum; complete single lever manual control; electric timer dwell control, and constant feed regardless of resistance.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.



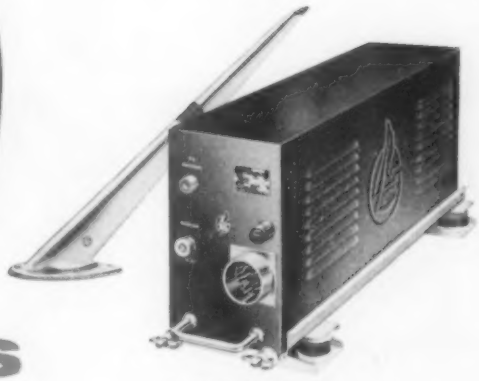
Threaded Bolt Spacer

Self-locking threaded type bolt spacer is two-piece unit consisting of plug and tapped sleeve containing a nylon insert. Installation requires no special tools.—Delon Co., Inc., South Gate, Calif.

36

channels

crystal controlled

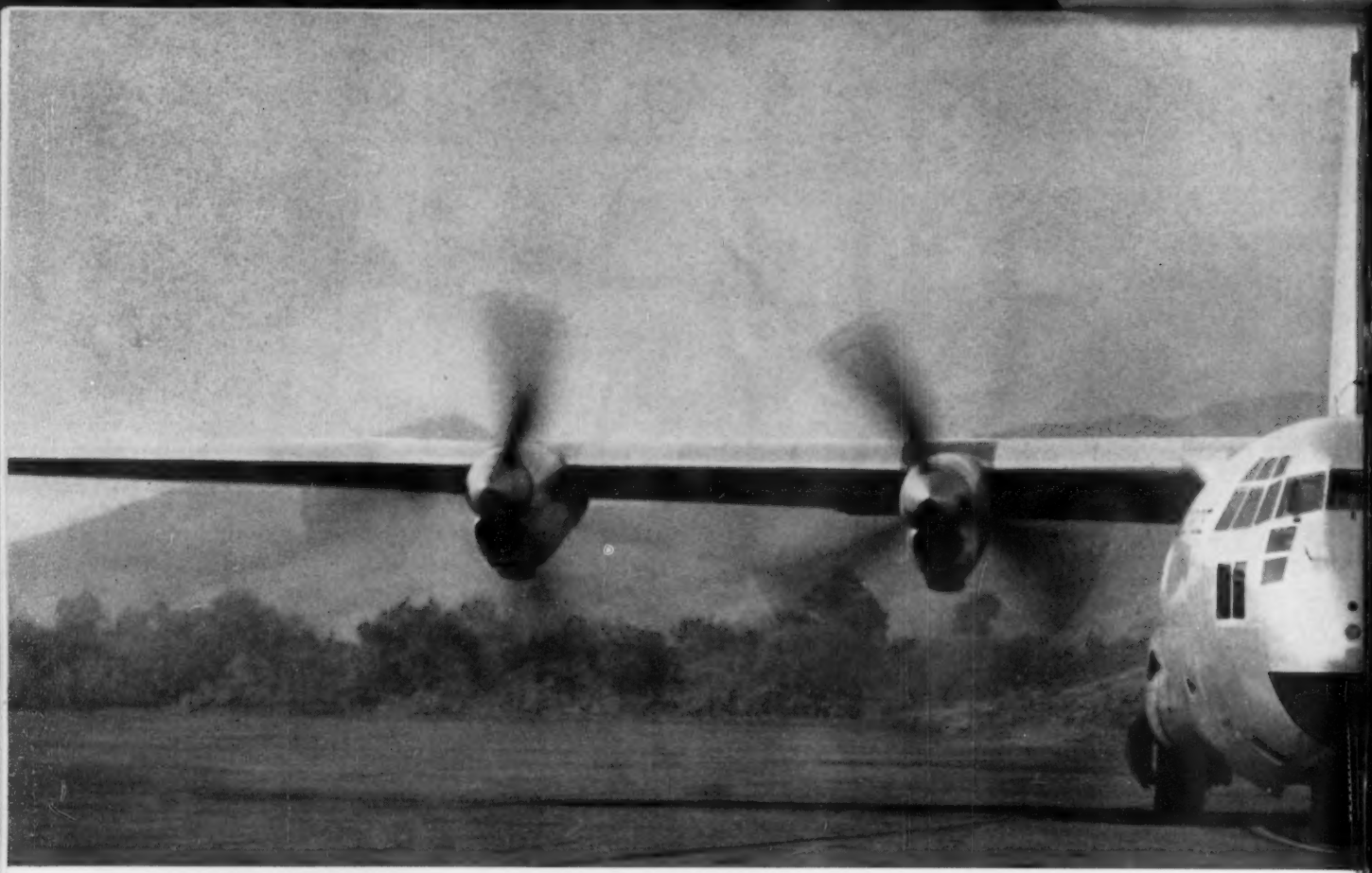


LEAR LVTR-36

Forget about manual tuning. Just flick a switch. With the Lear LVTR-36 you get 36 VHF channels, all crystal controlled, for transmitting and receiving. Powerful, speedy, dependable communications! Send for information today.

LEAR LEARCAL DIVISION 3171 SOUTH BUNDY DRIVE, SANTA MONICA, CALIFORNIA

LC-16



MISSION: TACTICAL AIR MOBILITY. Mobility of men and materiel is a vital problem in the new atomic era. So the Air Force needs a high-speed, low-slung combat cargo plane that can use even short, improvised runways. The new C-130 Hercules with turbo-prop power (Allison T-56 engines) will do this. Now in production at Lockheed's Georgia Division, Marietta, Ga.

A Pentagon Secret

If you were in the vicinity of Alamogordo, Inyokern, Dayton, Muroc Dry Lake or Patuxent River, you would hear new sounds and see strange shapes in the skies. These and other military research centers are constantly testing the new flight forms developed jointly by industry and the military—admirals, generals and thousands of officers and enlisted men.

The unique talent of our military executives to mobilize science and industry is the Pentagon secret. In this fast-moving age, our defense needs are ever-changing. This requires new weapons, new aircraft, and whole new concepts of defense. The job of planning and developing these is now the biggest business in the world.

Each new defense device is designed to perform a special and difficult mission. And each originally presented our military executives with a major problem in planning, designing, development and production. Typical of today's defense problems and the machines designed to solve them are the products illustrated on these two pages.

IF YOU'RE A YOUNG MAN, 17 TO 28, INVESTIGATE MILITARY AVIATION AS A CAREER

MISSION: POWER RESEARCH. To prove how even advanced turbo-prop engines could be used on existing air frames designed for piston power, the Navy and Air Force selected Super Constellations (below). Result: these Super Constellations are the world's fastest propeller-driven airplanes, and are now flying for our military. Lockheed is leading the industry in turbo-prop power. Look for the new Lockheed Electra commercial transport with this advanced power. Already ordered in quantity by American Airlines, this advanced airliner promises speeds up to 100 mph faster than commercial transports now in service, and amazing new operating economies for airlines. For travelers throughout the world, the Electra will provide quicker schedules, quieter comfort. Lockheed's vast experience in turbo-prop aircraft will make possible record production schedules.

MISSION: MISSILE SUPREMACY. Ultimate goal of the research and development at Lockheed's Missile Systems Division is a completely reliable, broadly versatile array of guided missiles. Lockheed's MSD has more than 2,000 topflight scientists, physicists, nuclear physicists, engineers and technicians covering virtually every field of science at Van Nuys, Calif., Alamogordo, N. M., and Patrick Air Force Base, Fla.

MISSION: INTERCEPTION. (Right) This condensation trail is a phenomenon caused by great speed at high altitude—symbol of the Air Force's new F-104 Fighter, the Lockheed supersonic interceptor too secret to photograph.

Lockheed

AIRCRAFT CORPORATION

California Division, Burbank, Calif.
Georgia Division, Marietta, Ga.
Missile Systems Division, Van Nuys, Calif.
Lockheed Air Terminal, Burbank
Lockheed Aircraft Service, Burbank

LOOK TO LOCKHEED FOR LEADERSHIP

MISSION: JET TRAINING. Aircraft carrier jet fighters require highly skilled pilots and, to train them, the U. S. Navy needed the world's safest jet trainer. The new T2V-1, the Navy's first carrier jet trainer (shown below), is a product of close Navy-Lockheed cooperation. Flying about 600 mph, it can land under 100. Better visibility and a raised empennage for improved control are other new features.

MISSION: EARLY ENEMY DETECTION. Like climbing a mountain for a better view, the Navy and Air Force "go upstairs" with radar stations on Super Constellations—long-range planes capable of carrying *tons* of 360° radar. Result: more hours of earlier warning. Below, Navy crews at Pearl Harbor pass inspection near their Early Warning Super Constellations.

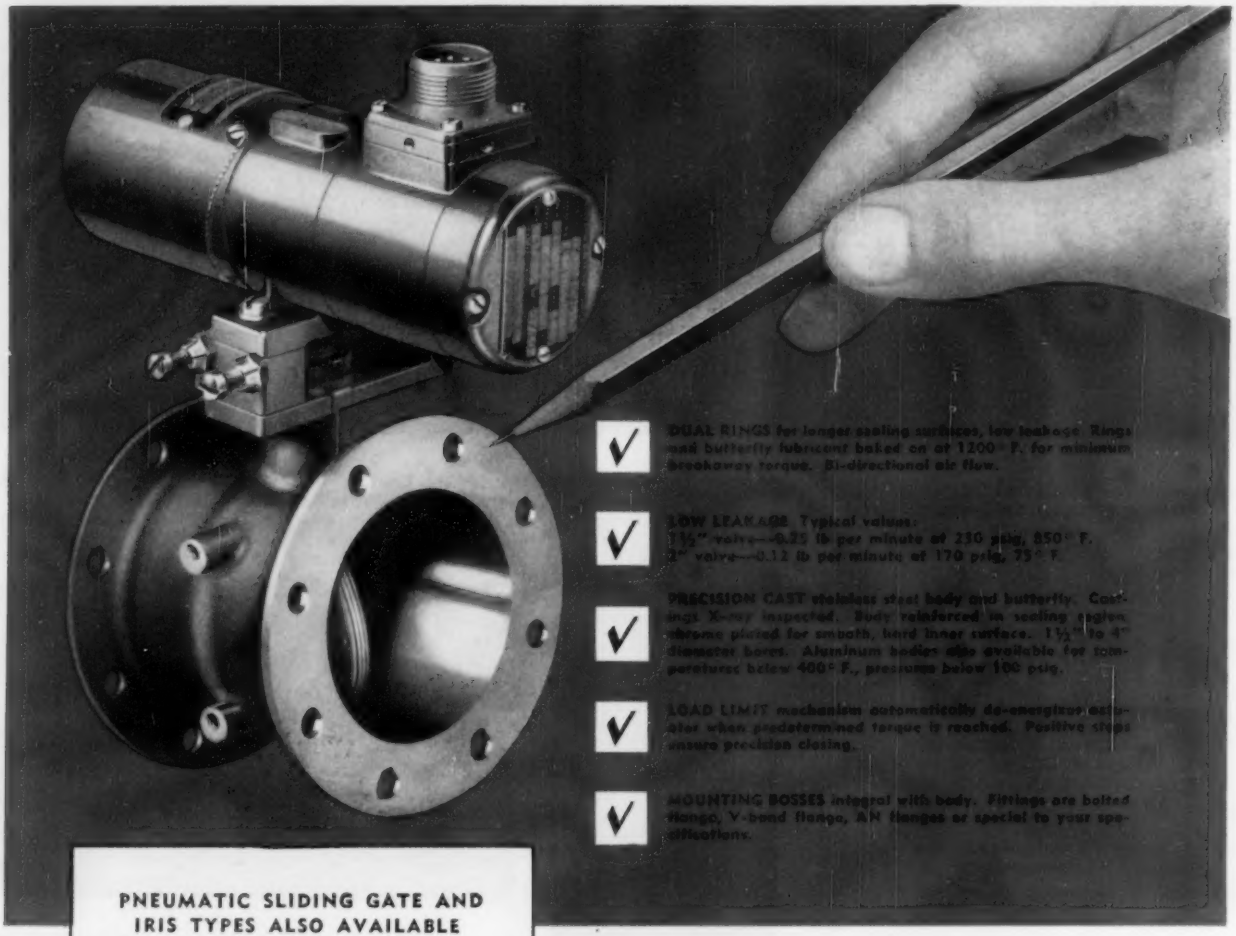
MISSION: COASTAL PROTECTION. No other nation has so much coastline to protect from submarine or air attack. The Navy and Lockheed have continuously developed Neptune Patrol Bombers (P2V) for this mission. In addition to high speed and long range, this plane (below) typifies Lockheed's leadership in the application of electronics to aircraft.

BARBER COLMAN

Aircraft Controls

. . . new, improved butterfly air valves for higher pressure, higher temperature applications

Keeping pace with the aircraft industry's ever-increasing temperature and pressure requirements, Barber-Colman Company maintains a constant program of air valve improvements. The advanced type motor-actuated butterfly valve shown here is an example of the new developments that continuously result. Featuring extremely low leakage, this new Barber-Colman air valve is designed especially for today's high temperatures and pressures . . . up to 900° F., 250 lbs. per square inch. Proof pressure at 900° F. is 460 psig. This valve is particularly suited to control of air in pressurization, refrigeration, and heating systems . . . anti-icing systems, purge gas systems, exhaust bleed systems . . . and many other applications. Barber-Colman butterfly valves, as well as sliding gate and iris types, are available in a wide range of sizes to meet most requirements. Special designs can also be developed where needed. Thus, when designing any system in which air is handled, consult Barber-Colman engineers for the valve best suited to your application.


✓ DUAL RINGS for longer sealing surfaces, low leakage. Rings and butterfly lubricant baked on at 1200° F. for minimum breakaway torque. Bi-directional air flow.
✓ LOW LEAKAGE. Typical values:
✓ PRECISION CAST stainless steel body and butterfly. Castings X-ray inspected. Body reinforced in sealing region, chrome plated for smooth, hard inner surface.
✓ LOAD LIMIT mechanism automatically de-energizes actuator when predetermined torque is reached. Positive stops ensure precision closing.
✓ MOUNTING BOSSES integral with body. Fittings are bolted flange, V-band flange, AN flanges or special to your specifications.

PNEUMATIC SLIDING GATE AND IRIS TYPES ALSO AVAILABLE

PNEUMATIC SLIDING GATE—Illustrated is a 1¼" pneumatically operated slide valve. Extremely low leakage — 0.04 lb per minute at 850° F., 230 psig. Pilot solenoids provide proportioning action. Weighs only 1.88 lbs.

IRIS—For low pressure ventilating systems. Utilize Barber-Colman load limit actuators for precision closing. Sizes range from 3" to 15".

The complete line of Barber-Colman aircraft controls includes: Valves; Positioning Controls; Actuators; Temperature Controls; Small Motors; Ultra-Sensitive Relays; Thermo-Sensitive Elements. For complete information on valves, write for Bulletin F-6021-1. Engineering sales offices in Los Angeles, Seattle, Baltimore, New York, and Montreal, Canada.

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Aircraft Controls • Automatic Controls • Industrial Instruments
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ALSO ON THE MARKET

Ball grinding attachment has been designed for use on surface or tool-grinders and is guaranteed to hold 0.001-in. accuracy, the maker reports. Unit has a built-in diamond setup gage and is supplied with a precision three-jaw chuck having a repetitive 0.0001-in. accuracy.—Nite, Inc., Copiague, N. Y.

Longitudinal welding fixture welds 0.005 to 1-in. thicknesses and is available in 2 to 12-in. lengths. Narrow hold-down fingers pivot and are adjustable in and out.—Airline Welding & Engineering, 785 N. Prairie Ave., Hawthorne, Calif.

Deep-throat punching press, 1.5-ton, 7-in. Model 1R, comes in bench-model version or legs can be added for floor work. Ram hole is 1 in. in diameter and 1.5-in. deep. Drive mechanism is self contained in the clutch collar. —Kenco Manufacturing Co., 5211 Telegraph Rd., Los Angeles 22, Calif.

Dial snap gage Setmaster adjusted to an exact setting, which is then used to check the dial indicator gage at any time, eliminating need for costly setting disks, the manufacturer states. . . . Firm also offers Model 985 large in-

side or outside diameter gage, a fully adjustable device, whereby diameters from 6 to 48 in. can be obtained by interchanging tube center sections.—Boice Manufacturing Co., Inc., Staatsburg, N. Y.

Diaphragm of chemically inert fluorocarbon resins for use in valves, controls and process equipment are made of Fluorflex-T (Teflon).—Resistoflex Corp., Belleville, N. J.

Spot welder three-phase Modu-Wave PMCO2ST model is available in 100 kva. at 50% duty cycle with either 36-in., 48-in. or 54-in. throat depth and electrode forces up to 4,300 lb. at 80 psi, line pressure.—Sciaky Bros., Inc., 4915 W. 67th St., Chicago.

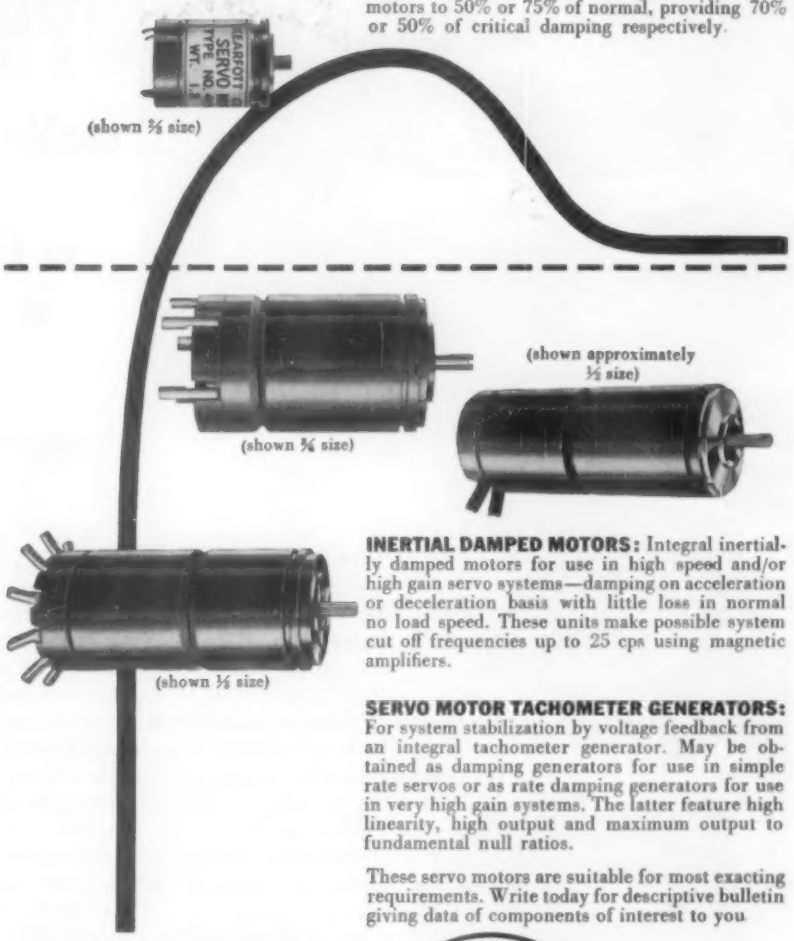
Low-force heavy-duty limit switch is designed for use on counting devices or

There is no one "cure all" for system instability. The desired stability of a servo loop is attained through the proper selection of components that satisfy the various conditions under which the loop will operate. Kearfott offers four basic motors and combinations for providing system stability. All feature high speed of response; low inertia and high stall torque.

SYSTEM STABILITY

SERVO MOTORS: Servo motors with high torque to inertia characteristics possessing (built-in) inherent damping ranging in size from ¾" to 1¾" diameter are available. Low speed, low power motors for use in simple instrument servos where high damping and/or low time constant is required can also be provided.

VISCOUS DAMPED SERVO MOTORS: Provide integral viscous damping for simple instrument servos. Any degree of damping can be provided. These units reduce no load speed of standard motors to 50% or 75% of normal, providing 70% or 50% of critical damping respectively.



INERTIAL DAMPED MOTORS: Integral inertially damped motors for use in high speed and/or high gain servo systems—damping on acceleration or deceleration basis with little loss in normal no load speed. These units make possible system cut off frequencies up to 25 cps using magnetic amplifiers.

SERVO MOTOR TACHOMETER GENERATORS: For system stabilization by voltage feedback from an integral tachometer generator. May be obtained as damping generators for use in simple rate servos or as rate damping generators for use in very high gain systems. The latter feature high linearity, high output and maximum output to fundamental null ratios.

These servo motors are suitable for most exacting requirements. Write today for descriptive bulletin giving data of components of interest to you.

KEARFOTT COMPONENTS INCLUDE:

Gyros, Servo Motors, Synchros, Servo and Magnetic Amplifiers, Tachometer Generators, Hermetic Rotary Seals, Aircraft Navigational Systems, and other high accuracy mechanical, electrical and electronic components.

Kearfott

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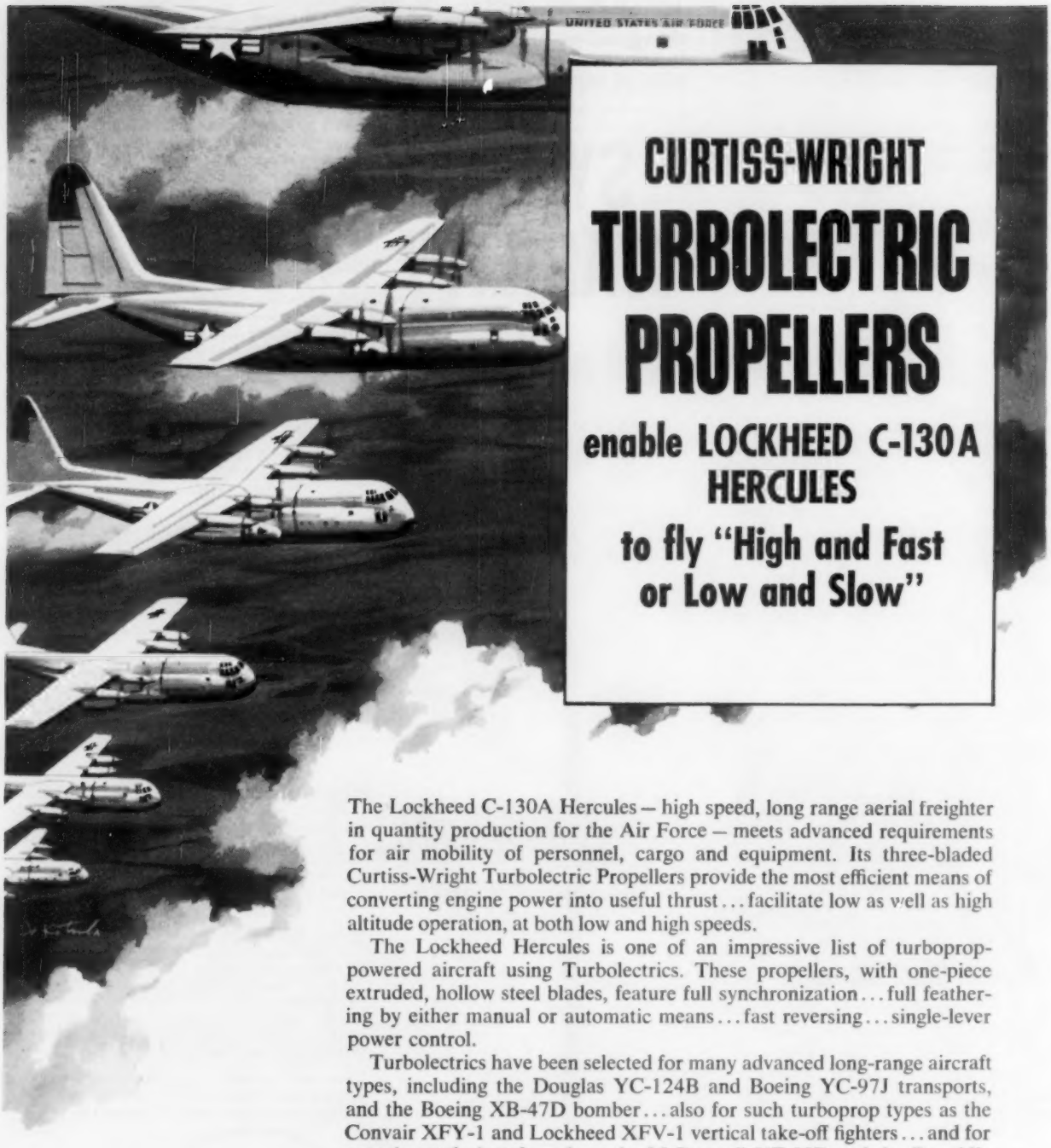

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3	2"	11S3	36SR3
4	2"	11S4	36SR4
5	3"	10S5	37SR5
6	3"	10S6	37SR6
8	3"	10S8	37SR8
9	3"	10S9	37SR9
10	3"	10S10	37SR10
12	3"	10S12	37SR12
16	3"	10S16	37SR16
18	3"	10S18	37SR18
20	3"	10S20	37SR20
24	4"	27S24B2	38SR24
28	4"	27S28B4	38SR28
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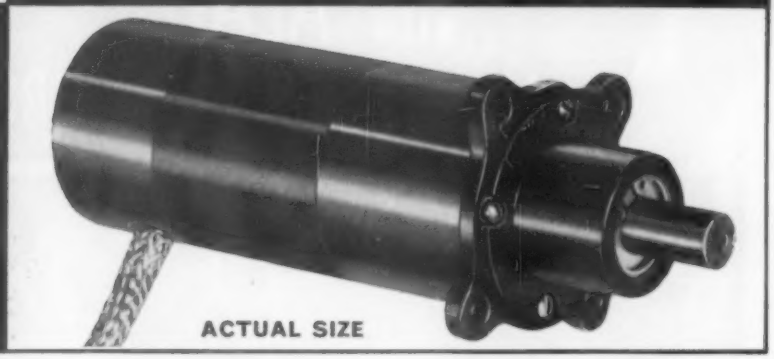

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400	15:1 to 5,500:1
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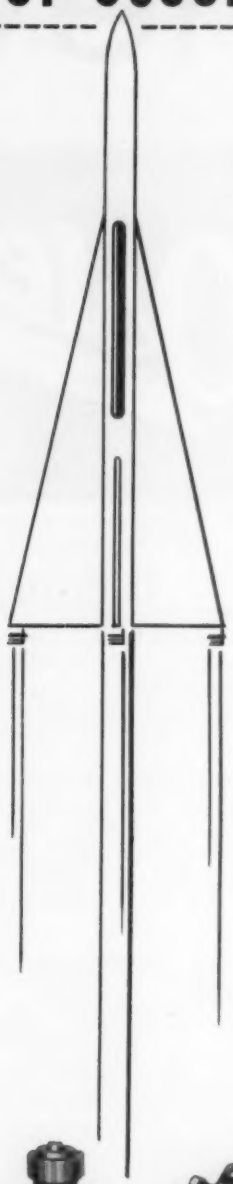

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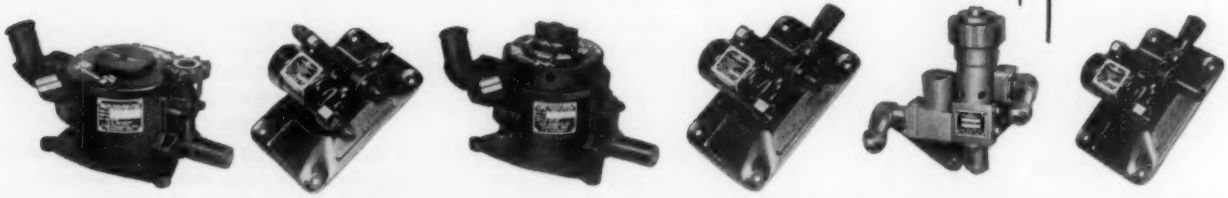

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LETTERS

More on Models

Couldn't help but write you after reading in your letters column in the July 25 and July 4 issues regarding airminded youth.

Being in the model airplane manufacturing business, maybe I'm stepping out of line to EXPLODE.

If I've read it once, I've read it a hundred times, by aviation executives: ". . . model aviation is of vital importance to the aviation industry, as many of today's top engineers and test pilots were once modelers."

Yet, these same executives do nothing to encourage, or help model aviation. They spend countless thousands in consumer magazines selling the reader nothing. They spend thousands recruiting engineers and test pilots. Your July 25 issue carried no less than 10 full pages recruiting engineering help, to the tune of nearly $7,000.

Now don't get me wrong, I'm not hitting advertising or their methods, far from it. I'm only trying to point out that a few dollars spent to further model aviation could pay off later. How much less costly would it be now if 10 years ago they would have set aside a few dollars to encourage model building.

How about the industry as a whole? Isn't it true that many of the model airplane builders become successful business men, men who may be in a position to utilize air travel? If these successful business men were once modelers, don't you think it is going to be much easier to sell him on the idea of a company-owned plane, or air travel? Maybe some readers think I'm talking in small numbers. Does 10 million sound big? Yes, there are 10 million model aviation enthusiasts in the United States today, and this number can double in the next 10 years —or it can become smaller—depending on what is done to encourage airminded youth.

If the aviation industry will stop and think, they'll see just how important this little model builder can be to the industry.

I've probably said too much; sure as there's propwash, some reader is going to say, "Well, why shouldn't that fellow be interested in the model industry, after all that's his business."

I'd suggest that any aviation firm who thinks I've got a point write to the Academy of Model Aeronautics, 1025 Connecticut Ave., N. W., Washington 6, D.C., and offer whatever help they can.

RICHARD A. DINKEL
28 Ionia Ave., S. W.
Grand Rapids, Mich.

British Turboprops

In the paragraph headed "British Transport Worries" in your issue of 18th July, contributed by your Washington staff, it is stated: "Fact is that both the Pratt & Whitney turbo-jet scheduled for the DC-8 and the Allison turbo-prop scheduled for the Electra will have far more operational service by the time these commercial airliners are delivered than any British engine in either class".

It is our belief that this is unlikely to be so in the case of the turboprop, as the Bristol Proteus, which has already accumulated considerably more running experience than any other high-power turboprop engine, will go into operational service in the Britannia 100 next year.

The running figures for all types of Proteus to date are: total bench hours, 31,000; total flying hours, 10,000. Figures for the Proteus 700 series are: total bench hours, 14,000; total flying hours, 7,500. A conservative estimate of flying hours based on BOAC's proposed schedule for Britannia aircraft is something approaching 180,000 hours by June, 1957.

PETER KING
Public Relations Officer
The Bristol Aeroplane Company, Limited
Bristol, England

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Calvert on Slopeline

In his letter in your issue of 13th June (page 79), Mr. Pearson repeats the claim that because three test pilots at LAES made a number of landings "with as little as 500 feet of (slopeline) bars visible," whatever that may mean, it follows that the visibility limit at civil airports could be lowered to something well below that now in use at London, (slant visual range 1500 feet), provided that the slopeline pattern was universally installed and pilots were forced to learn to use it. I would like to make a few remarks about this, not because they will enlighten Mr. Pearson, but because they may be of general interest to operators.

When one makes the statement that any complete landing system, i.e. aircraft plus beam plus coupler plus lights, is *operationally* usable down to a certain slant visual range, one is really saying that the *probability* of a successful landing at that range is a certain fraction. In addition, one is assuming that the pilot has a standard of proficiency in instrument flying and that he is piloting an aircraft with certain response characteristics and with a downward view of not less than, say, 8°. The statement has thus a precise meaning only if the visual coupling is standardised, which means that we have to set up a standard civil visual pilot for each particular guidance pattern. This is the gentleman known to IATA conferences as "Joe" and the question is not what LAES thought in 1947, but what Joe regards as visual guidance at the various heights when doing his routine job with present day aircraft, beams, couplers, etc. His responsibilities, his experience and the requirements of the traffic pattern make this job very different from that of a test pilot making perhaps his five-hundredth

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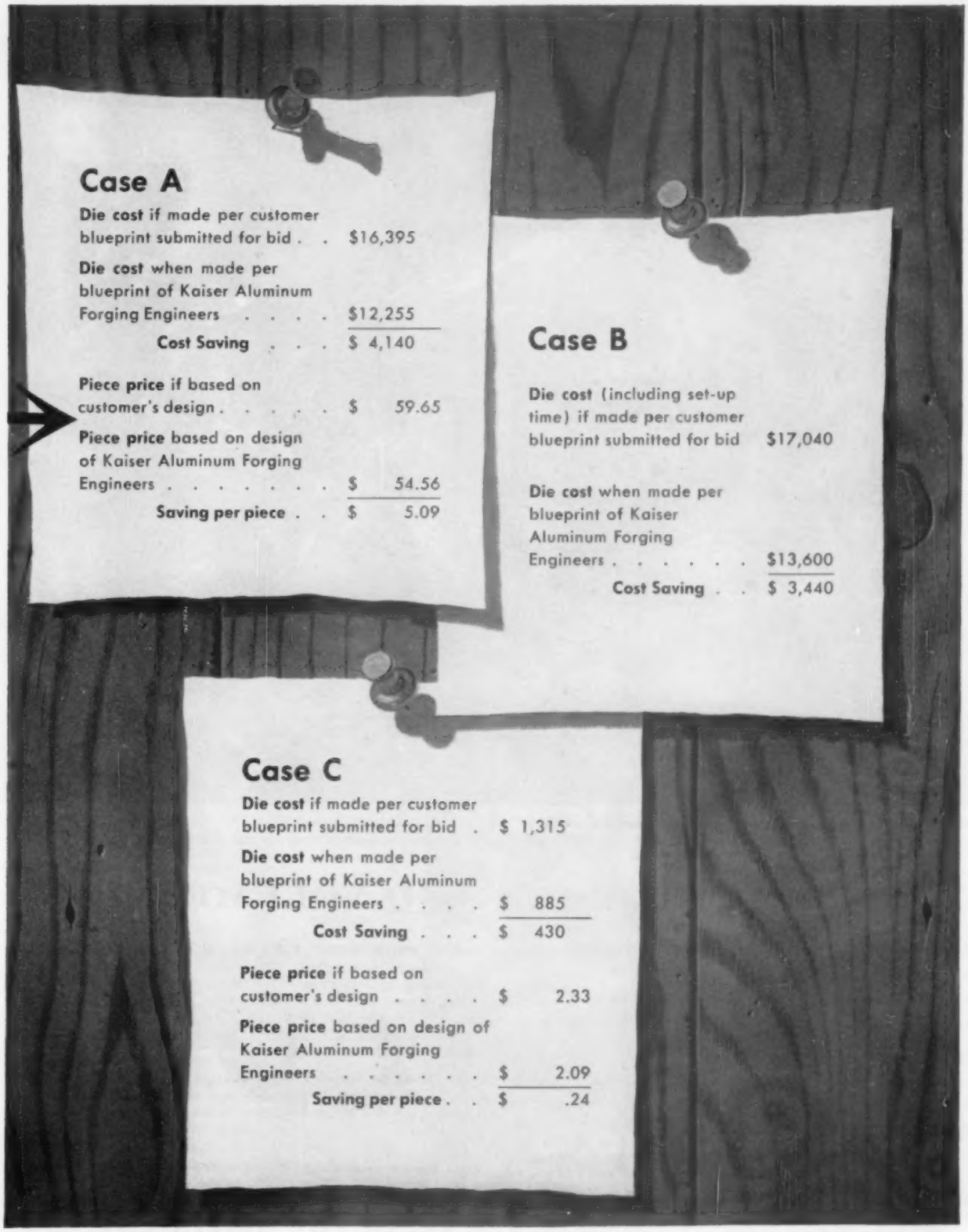


Case A

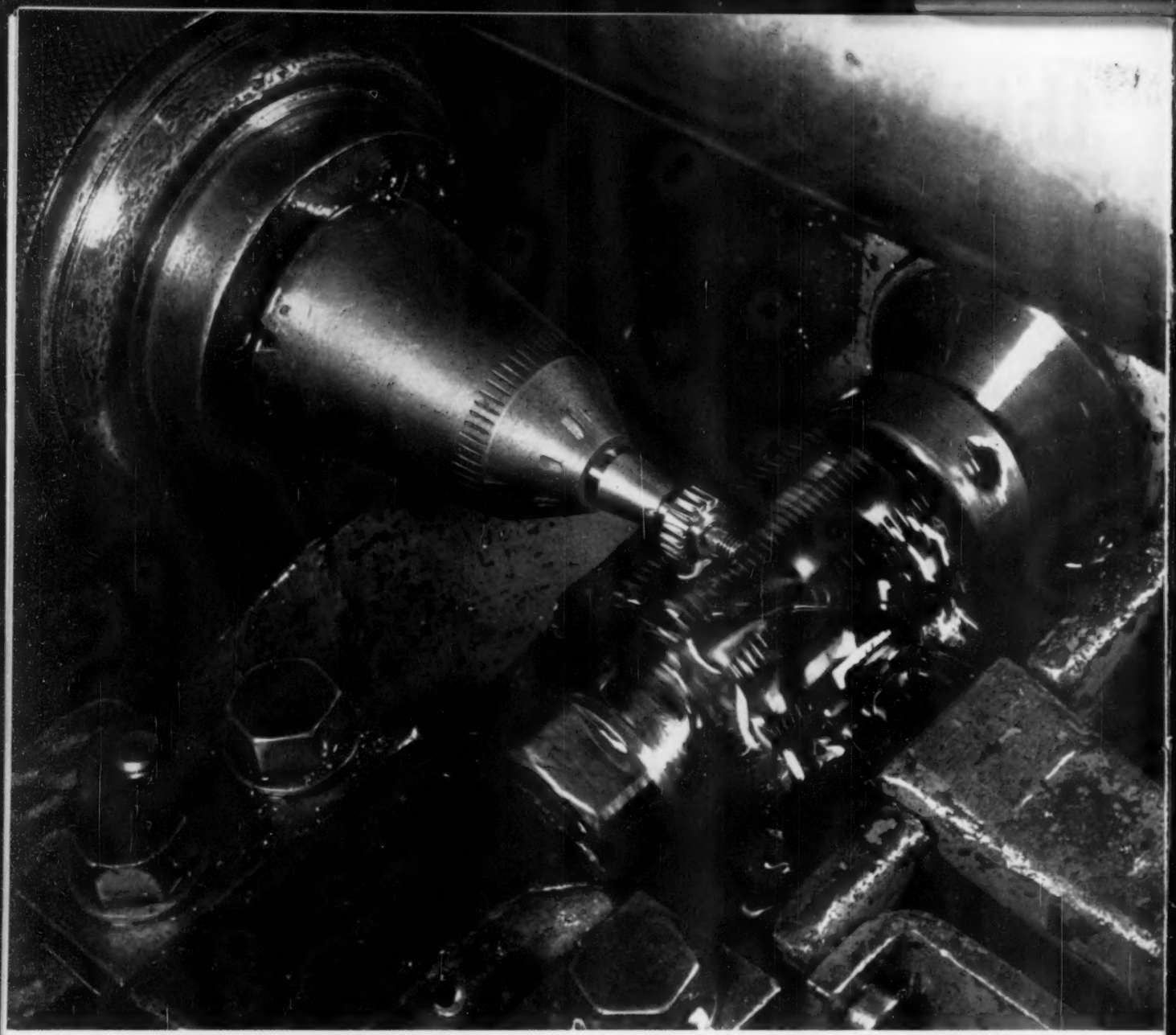
Die cost if made per customer blueprint submitted for bid	$16,395
Die cost when made per blueprint of Kaiser Aluminum Forging Engineers	$12,255
Cost Saving	$ 4,140
Piece price if based on customer's design	$ 59.65
Piece price based on design of Kaiser Aluminum Forging Engineers	$ 54.56
Saving per piece	$ 5.09

Case B

Die cost (including set-up time) if made per customer blueprint submitted for bid	$17,040
Die cost when made per blueprint of Kaiser Aluminum Forging Engineers	$13,600
Cost Saving	$ 3,440

Case C

Die cost if made per customer blueprint submitted for bid	$ 1,315
Die cost when made per blueprint of Kaiser Aluminum Forging Engineers	$ 885
Cost Saving	$ 430
Piece price if based on customer's design	$ 2.33
Piece price based on design of Kaiser Aluminum Forging Engineers	$ 2.09
Saving per piece	$ .24



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landing at an airfield at which he lives and works.

Slant Range

By examining the records of thousands of instrument approaches, taking the views of experienced pilots and making tests under controlled conditions on a good simulator, it is possible to set up a curve of slant range against height which closely represents Joe's requirements for visual guidance for the particular pattern. (I have done this for a runway with the crossbar pattern and for one with no approach lights at all). If the curve for a particular pattern is combined with the curve giving the approach success of the aircraft-coupler combination, expressed in the way proposed by Sperry and developed by Mercer, then one gets a curve connecting slant range with the *landing* success rate for the complete system. In other words, complete landing systems can be compared in terms of the weather they will defeat in actual operations at any given level of landing success. By this means, the effect of changes in pattern, coupler, aircraft response, or instrument approach speed, can be assessed on a scientific basis, even though the curve taken for the visual coupler does not correspond exactly to any particular group of pilots. A grasp of scientific method was, perhaps, not an outstanding characteristic of the committee which guided the work of LAES and they never attempted an analysis of this kind.

If the published figures are correct, then the curve which represents Joe on the slope-line pattern is about the same as the curve which represents Joe on a runway with no approach lights at all. It seems to me that the conclusion to be drawn from this is that if the lighting pattern is one which is so unfamiliar to the ordinary operational pilot that he has to "learn" it, then he simply hangs on to his electronic aids until he reaches a height at which he sees enough of the runway to provide the guidance which he regards as adequate for the type of operation. If the runway does not come into view by the time the aircraft has descended to a certain height, then he overshoots. In these circumstances the approach lights merely reduce the mental tension by providing a positional check and the landing success rate is much the same as it would be without them. If, on the other hand, the pilot knows that he can fly safely and easily on the approach lights, then he will make the transition to visual references and begin his final corrections at a greater height for the same slant range.

Failure Rate

The fact that a small increase in transition height around the 140-220-foot region has a large effect on the landing success rate explains, I think, a large part of the difference in the figures published for London and those for most airports in the United States. As your readers may know, the failure rate in a meteorological visibility of half a mile in 1950 was over 30% at most airports in the United States, as against less than 2% at London. Furthermore, the failure rate at London rises to only 6% when the runway visual range falls to 1500 feet. No doubt the United States figures have improved greatly in recent years by the introduction of couplers using rate in-

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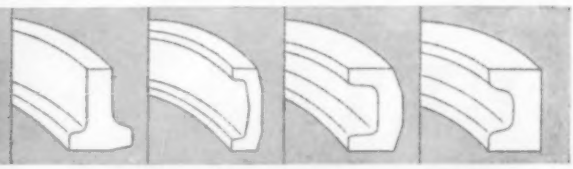

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formation but good approach lights would have produced much the same effect, with greater reliability and safety. To that extent I agree with Mr. Pearson. Indeed my main object in writing this letter is to suggest that a system analysis of this kind should be made independently in the various countries on their particular patterns. Besides settling many things which at present are matters of opinion, it would provide a proper basis for the design and setting of the lights.

Two minor points. Firstly, Mr. Pearson's argument about the effect of cut-off if fallacious, but even if it were true, the slope-line pattern would be affected more than the crossbar pattern, because the right hand row of slopelights is nearly twice as far to the right of the centre line as the extremities of the bars on the crossbar pattern. Secondly, why are criticisms of the slopeline pattern always "dug up"? Can it be that even Mr. Pearson regards it as dead and buried and that he thinks the only decent attitude is de mortuis nihil nisi bonum?

E. S. CALVERT
Bears House
Upper Park Road
Camberley England

The writer invented the British Calvert approach Lighting system.—Ed.

Short-Haul Answer

I was very much interested in Capt. Robson's recent column in which he discussed the qualities desired in a short-haul passenger airliner ("Short-Haul Short Story," AW June 20, p. 68).

I agree with your statement that the importance of short-haul aircraft to the aviation industry can hardly be overemphasized. The corporation of which the writer is president is working on developments which we feel will provide the answer to short-haul passenger needs and enable aviation to penetrate into this very large-transportation field.

Our feeling is that first-class short-haul passenger service requires a passenger-operated roadable airplane capable of running down city streets or a passenger-operated direct-lift aircraft reliable enough to be permitted to fly over and land and take off in the congested downtown areas of cities—in short, a passenger-operated aircraft capable of providing complete point-to-point transportation coverage.

The scheduled airlines are poorly suited for first-class short-haul passenger travel for two very fundamental reasons which improvement in airline equipment is not likely to alter materially.

The first reason arises out of the fact that the airline is scheduled, which means that instead of being able to go where he wants to go when he wants to go, the passenger must adjust his own schedule to suit the airline or wait around for a half-hour to a half-a-day while the airline rounds up 30 or so other passengers to fill up an airliner with a reasonable load.

The second reason is that once the passenger is dumped at an airport somewhere near his destination after a very short and luxurious air ride he is reduced to the status of a pedestrian, subject to all of the whims and limitations of local bus and taxi companies.

In nine situations out of 10 the passenger is better off driving his own car (if he has one) on trips up to as long as 200 to 300 miles at the present time.

Unfortunately for all forms of scheduled carriers, the private automobile has so monopolized the local transportation picture in most American cities that the amount of traffic that can support common carriers is reduced to the point where only second-rate service can be provided the poor pedestrian. Automobile sales figures, superhighway construction, etc., don't give any hope that short-haul airlines will be spared from devastating competition from the automobile any less in the next 10 or 20 years than inter-urban passenger railroads have been in the past. In fact it looks as if the trip lengths within which the private vehicle competes with common carriers are tending to increase rather to shorten.

There will always of course be people who don't own automobiles or who can't rent them or who can't afford inter-city taxis and who will, nevertheless, want to travel. This business will probably not grow much from an overall picture, but much of it can be diverted from surface bus and railroad lines into short-haul airlines.

The success of an airline in capturing this business will depend primarily on how well the airline schedule is coordinated with local transit systems at both ends of the flight and, of course, the majority of the passengers will be very price conscious.

CHESTER R. HAIG, *Jr.* President
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Buffalo, N. Y.

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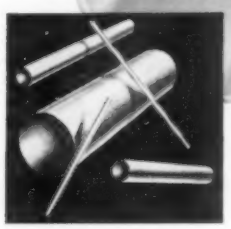

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AiResearch engineers developed a technique for stepping up the cooling efficiency of their heat transfer units 26% . . . they dimple the tubes used in the construction of their heat exchangers. The dimples interrupt the smooth flow of air through the tubes and permit more rapid exchange of hot and cold molecules. But in service use these tubes are subjected to high temperatures where ordinary materials won't stand up.

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Trent Tube Company engineers have successfully solved many other application problems for stainless and high alloy tubing. Their services and broad background of experience are available to help you solve yours. If you use any form of tubing, why not call in one of our representatives. And remember, *you can't buy better tubing than* TRENTWELD.

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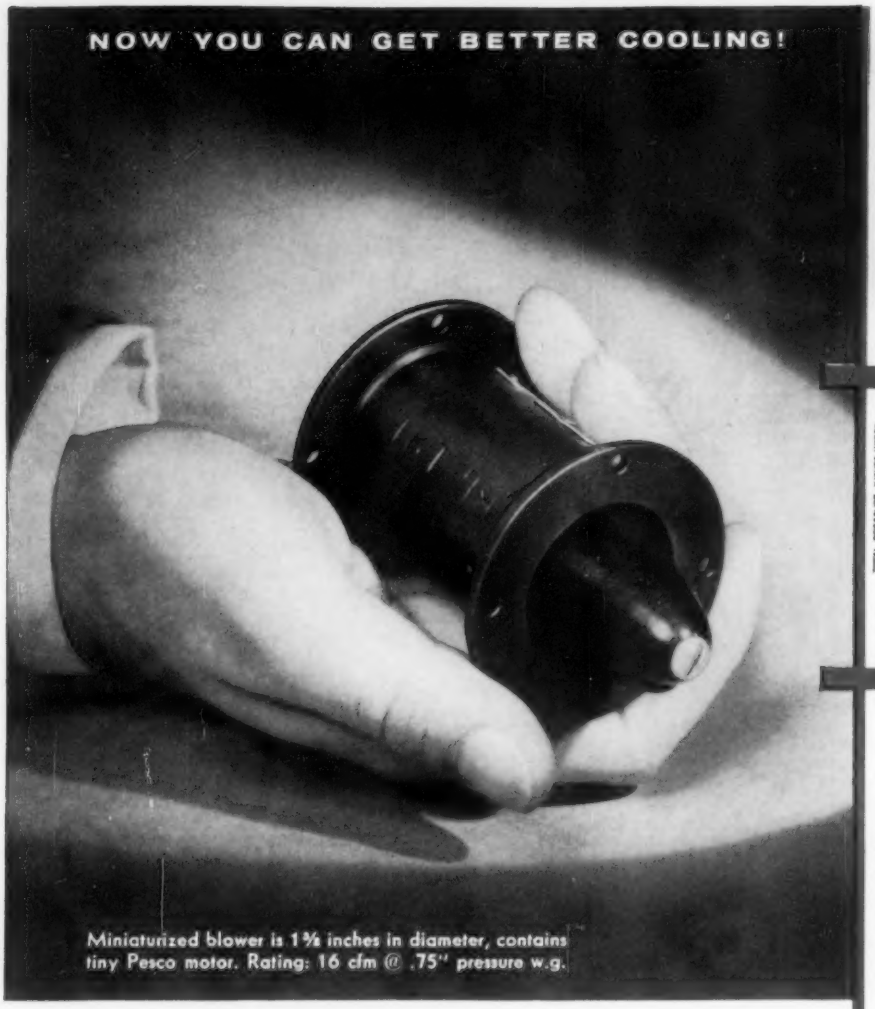
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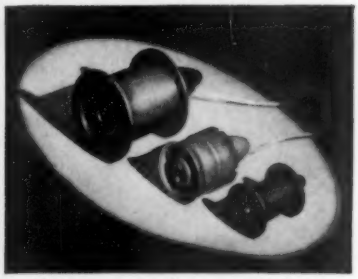
COMPLETE LINE



Units for a-c or d-c operation have capacities from 16 to 750 cfm.

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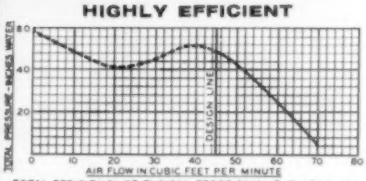

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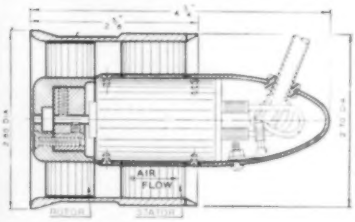

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U.S.-Latin America Interchange Approved

National, PanAm, Panagra routes linked to offer DC-7B, DC-6B through-service to Buenos Aires.

By G. J. McAllister

Washington, D. C.—Prompt approval of the Panagra-National Airlines-Pan American World Airways interchange proposal for through service from New York to Buenos Aires along South America's west coast came from Civil Aeronautics Board last week after several last hour submission delays.

The through plane service is expected to start Aug. 24. Eastern Air Lines and Braniff International Airways will start their through service from New York to South America Aug. 18. Their interchange plan won CAB approval last month.

Here is the way the Panagra-National-PanAm interchange will work:

- **National will operate** two round trips daily between New York and Miami using Panagra equipment. One trip, using DC-7Bs, will be the first class El Inter Americano and the other will be a tourist class flight, El Pacificio, using DC-6B equipment. The trip continues on Pan American's Miami-Balboa route and then on Panagra's South American route.
- **National will have the option** of furnishing the necessary additional equipments. If the number or through trips exceeds 21 per week.
- **Stops at Washington, D. C.,** along National's New York-Miami route will be made if agreed upon by the carriers. However, the stops will not be made on such a number of schedules that it would defeat the purpose of the New York-South America through flight.
- **Schedules will be fixed** to give the most convenient and advantageous service to through traffic with consideration for adequate loads of domestic and international traffic.
- **The carriers will share** expenses for the promotion of the new through service. Names of the carriers will be displayed at the ticket counters of the three carriers involved. Panagra aircraft used in the interchange will carry National's insignia.
- **Panagra will overhaul and maintain** its aircraft except for turn-around maintenance necessary while the aircraft is being flown by National.

Final Chapter

The interchange agreement filed with CAB is the final chapter in the five-year-old Balboa case that has been enlivened by sharp feuding involving the carriers, the board and the White House.

Panagra, which is owned 50-50 by Pan American and W. R. Grace & Co., and Pan American originally sought to sign separate agreements with National. This produced a sharp series of letters to the Board from PanAm and Grace & Co.

Each company accused the other of obstructionist tactics. The Board finally ordered the three carriers to get together on an agreement—or else.

An anti-trust suit filed by Department of Justice against Grace, PanAm and Panagra further complicated an already involved relationship. CAB reportedly turned the letters over to Department of Justice for possible use in the anti-trust case. Justice wants Panagra to become an independent airline, free of control of both PanAm and Grace.

The agreement generally follows the pattern of the Eastern-Braniff interchange. Eastern-Braniff offers four roundtrip flights each week from New York to South America. Three of the flights will end at Rio de Janeiro operating by way of Panama, Lima and Sao Paulo. The fourth flight will continue from Lima to La Paz and Asuncion and terminate at Buenos Aires.

The Panagra flight proceeds down the west coast of South America from Panama to Lima, Santiago and across the Andes to Buenos Aires.

Panagra does not have service to Rio de Janeiro and Braniff does not fly into Santiago.

Panagra's Answer: Service

Panagra's management is confident that they will get the major share of the New York-Buenos Aires traffic because of equipment superiority. Panagra recently took delivery of two DC-7Bs and expects delivery in September of the last of five ordered. Braniff will use DC-6s.

Panagra Vice President Douglas Campbell has a one word answer to inquiries on Panagra's plans: Service. "We were the first carrier to use DC-6Bs in South America; we are the first to use DC-7Bs and we are already looking at the jet transports offered by Boeing and Douglas. We have put the finest available equipment on our routes and we will continue to do just that," Campbell told AVIATION WEEK.

Panagra started operations in South

America in September 1928. They used a single-engine, four passenger Fairchild which was capable of an average speed of 87 mph. compared with the 365 mph. cruising speed of the DC-7B.

When the DC-7Bs are delivered, Panagra will be operating a fleet of five DC-7Bs, five DC-6Bs, two DC-4s and four DC-3s. The DC-7Bs and DC-6Bs will operate in international service and the DC-4s and DC-3s will be used in what amounts to a feeder service in Bolivia and Ecuador.

Pioneer Operators

Campbell believes a prime reason for the growth of Panagra is the use of native personnel. "We have put our roots down deep," he said. Panagra has approximately 1,200 employes in South America and only 100 are North Americans. The airline also uses the local W. R. Grace & Co. offices as its agents in the cities it serves along South America's west coast. The Grace firm is well established in those countries. Buenos Aires is the only South American city where Panagra and PanAm operate a joint office.

Panagra started the first chain of radio facilities in South America for air navigation and operated them for 18 years.

The governments of Argentine, Peru and Colombia have purchased these facilities, but Panagra still operates communications in Ecuador, Bolivia and Chile.

Panagra is anxious to obtain a route to Rio de Janeiro from Lima by way of La Paz. "If we could obtain this route and in conjunction with our new through service to New York we could go a long way toward getting off subsidy," Campbell said. "But we will never get off subsidy," he added, "as long as most of our route system is paralleled by Braniff. And, in addition we have the national carriers to compete against."

Despite the competition, Panagra shows traffic gains. Air travel between the U. S. and South America along the Panagra route increased 10% in 1954 over 1953. Panagra in 1954 flew 149,099,000 revenue passenger-miles compared with 136,038,000 for 1953. Total revenue passengers carried reached a record 133,848 in 1954.

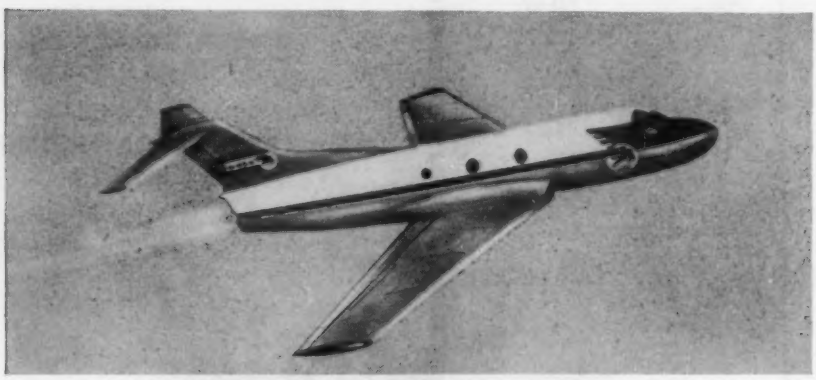
Tourist Promotion

Edward G. Bern, Panagra's vice president for sales and traffic, attributes part of the increase to the industrial expansion and economic growth of South American countries. "Few areas of the world offer greater promise of more rapid and profitable development," he said.

However, Panagra's total traffic to South America is still about 60% tourists.

The airline is spending substantial sums promoting South America for tourist travel, but has been unsuccessful in convincing the governments concerned to use their funds to lure tourists. Pangara officials believe it would be a sure-fire method of helping to solve South America's chronic dollar shortage problem. They point to the success of such tourist promotion programs carried out by European countries.

Although the interchange provides arrangements for cargo flights, Panagra is not actively promoting freight hauls. Reason: Virtually all of the cargo is southbound since the bulk of South American exports are staples that cannot be economically shipped by air. Lack of northbound cargoes makes it an unprofitable operation.



Proposed Fairchild M-225

Artist's sketch of proposed Fairchild M-225 light jet transport with cruising speed of 560 mph. The swept-wing jet was designed as an industrial executive transport and is equipped to carry crew of two and seven passengers. Design specifications call for M-225 to be powered by four Fairchild jet engines. Company officials say plan also should meet military requirements for transitional training use. Wingspan is 35 ft., 4 in., length 50 ft., 10 in.; height 13 ft., 3 in.; gross weight 17,695 lb. M-225 will have range of 1,280 nautical miles with maximum fuel load.

Cuban Freight Firm Gets Board Permit

Tuya Cuban Express Corp., a Cuban freight forwarder, has been awarded a permit by Civil Aeronautics Board for forwarding operations between the United States and Cuba.

The five year temporary permit issued to Tuya is subject to several restrictions:

- **Traffic is restricted** to movements from New York and Miami to Havana.
- **Tuya is authorized to handle only** outbound shipments from the United States to Cuba. No northbound traffic is allowed.
- **Freight must be moved only** in the aircraft of certificate or permit holders authorized for operation by CAB.

CAB rejected contentions that Tuya should have a general authorization for forwarding operations between the U. S. and Cuba.

Further expansion of the Cuban forwarder's authority will be granted only after public need has been shown in a permit proceeding.

Civil Transport Fleet Inadequate for War

An advisory group on mobilization has found that the civil air transport fleet would be 58 aircraft short of minimum requirements in the event of another war.

The mobilization estimates have been submitted to the Civil Aeronautics Board by the Industry Advisory Committee on Aviation Mobilization. The report gives estimates of minimum civil traffic needs in wartime.

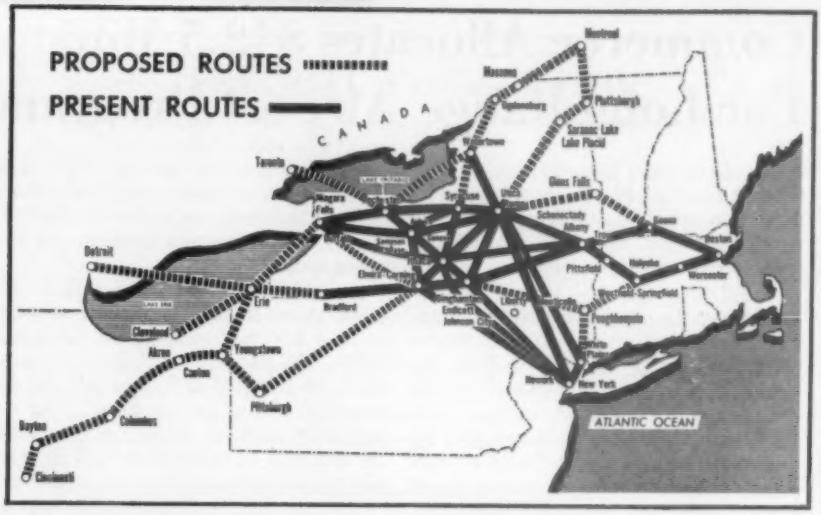
The committee finds that minimum essential requirements are 5.08 billion ton-miles for 1956, almost double the 2.58 billion carried last year.

The present fleet of civil transports, minus the Civil Reserve Air Fleet of 317 four engine aircraft, could carry 4.54 billion ton-miles in 1956, according to the committee. This capacity is based on a daily utilization of ten hours and a priority traffic load factor of 70%.

The deficiency in ton-mile capacity is translated into 58 modern large transport aircraft—20 passenger planes of the DC-7 and 1049G type and 38 cargo planes of the DC-6A type.

The committee told CAB that its estimates were very conservative and didn't take into account possible effects of large-scale bombing of the United States or other possible wartime contingencies.

CAB was further advised that the mobilization estimates should be revised annually or whenever events would indicate a reappraisal.



Mohawk's Future Plans Envision Change to All-Copter Operation

By Gordon Conley

Ithaca, N. Y.—Mohawk Airlines is working out a long-term expansion and re-equipment program that includes construction of a new $2-million headquarters and eventual conversion to an all-helicopter operation. The airline expects to be well into the preliminary steps when it receives its permanent certificate in June 1958.

The program is indicative of growth plans made possible for Mohawk and the 13 other local service lines by Congressional legislation approved last May. The new law forces the Civil Aeronautics Board to assure the small carriers of firm positions in the domestic air transportation network, allowing them to project their futures past seven years—the term of temporary permits previously granted by CAB.

Permanent certificates will be granted by the Board as the airlines' temporary permits expire (AW June 6, p. 14).

Long Range Program

Although Mohawk is next to last in line for its permanent license, its long range program is well under way. The projects, as outlined to AVIATION WEEK by President Robert E. Peach, include:

• **New $2-million headquarters.** Plans call for construction by July 1, 1958, of an operating base and integrated maintenance and general office facilities. The base and buildings will be designed for expansion to meet growth requirements during the next 30 years.

Site of the new headquarters may be moved from Ithaca, where Mohawk was forced to build its own airport and present facilities on land leased from Cornell University. Ithaca had no municipal airport when the airline inaugurated service 10 years ago, and city officials refused to build one because of the carrier's temporary certificate.

"But they know now that we'll still be in business in 1970," said Peach. "To keep us here, they'll have to take over and improve the airport, build a new passenger terminal and lease space to us. If not, we'll move somewhere else.

"We've got to get out of the airport management business. The capital tied up in this field would buy a new transport."

• **Re-equipment program.** Mohawk started operating three Convair 240s last July and plans to convert its entire service to this type within the next five years if the transport proves economical during the present six-month trial period. The airline's next step will be to an all-helicopter operation.

Mohawk picked the 240 as the replacement for its 11-plane fleet of DC-3s after studying the Convair 340, Martin 2-0-2 and 4-0-4, Fokker's turboprop F.27 and the Canadair CL-21.

If the Convair is operating economically by January, the airline expects to continue with its 240s until a rotary-wing transport that meets its requirements is available. Mohawk's proposed copter specifications: 30-40 passenger capacity; minimum cruise speed of 140 mph.; at least two engines and a direct operating cost of approximately 4 cents per available seat-mile on stage lengths between 150 and 300 miles.

The local service line will go into the new operation with rotary-wing experience gained during an S-55 experiment started in early 1954 and discontinued last March (AW April 25, P. 16).

• **Route extensions.** Mohawk has asked CAB for permission to extend its service from Utica and Watertown, N. Y., to Montreal; from Rochester, N. Y., to Toronto; from Elmira, N. Y., to Pittsburgh, Youngstown, Akron, Columbus, Dayton and Cincinnati, and from Bradford to Erie, Cleveland and Detroit (see map).

• **Terminal construction.** At least three cities on the carrier's route network are planning construction ranging from runway improvements to a complete new airport.

Ogdensburg, N. Y., is going to build a municipal airport, giving Mohawk access to the heart of the St. Lawrence Seaway. Elmira plans to construct a passenger terminal, and Pittsfield, Mass., is going to extend its runways and install new approach lights for night operations.

Traffic Development

Mohawk's new program is pointed toward one goal: making a deep pene-

Robert E. Peach, 35-year-old president of Mohawk Airlines, is one of the youngest chief executives in the air transport industry. He joined the local service airline as a flight captain Sept. 1, 1945, and became general traffic manager in July 1946. Seventeen months later, Peach was appointed general manager. He was elected executive vice president in 1948 and president in 1954.

The airline president began flying in 1940, and went on active duty with the Navy as a pilot on Dec. 7, 1941. His decorations during World War II included two Distinguished Flying Crosses and five Air Medals.

Peach received a bachelor's degree in business administration from Hamilton College in 1941. He also studied law at the University of Chicago and Cornell University before and after World War II.

tration of the short-haul travel market now nearly monopolized by railroads and buses. The carrier already is making substantial gains in this direction with its present equipment and facilities.

During the first six months of 1955, passenger revenues increased to $1,411,224—25% higher than the same period of 1954. The break-even mail pay need (subsidy) dropped to 16.1 cents per revenue-mile flown, 48.2% under last year's 31.1 cents. Net profit for the first half totaled $62,000.

In July, the first month of Convair operation, passenger traffic increased to a record 24,323. Passenger yield per aircraft-mile for the 240 was $1.27, compared with .865 cents for the airline's DC-3s.

But the Convair-Liners also increased Mohawk's subsidy need for July and will boost it again this month. Subsidy is expected to drop again after the two-month shakedown period, however, when the carrier's maintenance crews become familiar with the new aircraft.

PAA Wins New Route

Pan American World Airways has been authorized by the Civil Aeronautics Board to operate nonstop between New York and Ciudad Trujillo. PAA's new flights will compete with similar service by Varig Brazilian Airlines on its New York-Rio de Janeiro route.

CAB rejected the request of Eastern Air Lines that the authority be made temporary until EAL's New York-San Juan authority expires in March 1956.

The Board said it is confident that there is sufficient traffic potential and sufficient flexibility in Pan American's operation to allow the carrier to operate the service without increasing its subsidy.

"Indeed," said CAB, "we would be reluctant to authorize this new service, despite its evident public benefits, were we not so convinced."

Airworthiness Review

Annual review of airworthiness sections of the Civil Air Regulations during the week of Sept. 12 in Washington, D.C., was scheduled by Civil Aeronautics Board.

The work at the airworthiness meeting this year is to be split between two committees due to a lengthy agenda proposed last April.

First committee will be responsible for transport category airplanes, while the second group will handle miscellaneous aircraft. Written comments on the proposed CAR changes from interested parties unable to attend the meeting must be forwarded to CAB's Bureau of Safety Regulation prior to Sept. 10.

Commerce Allocates $42.5 Million For Long Range Airport Program

The Commerce Department is taking prompt steps to move into a high-level airport construction program and has urged cities and states to make long-range plans for future projects.

Legislation recently signed by the President authorized the Civil Aeronautics Administration to make contracts for federal aid up to $42.5 million for Fiscal 1956 and up to $63 million for the three following years.

"The firm authorization provided by this legislation for several future years would permit advance programming of future funds, that is, the tentative allocation of funds prior to the fiscal year in which grants would actually be made," Commerce Secretary Sinclair Weeks said.

"Some cities may be prepared with their own firm plans for several years in advance and may seek some form of commitment for matching federal funds to be made available in those future years. Obviously, such advance commitments would have advantages for the cities concerned."

In addition to the $42.5 million authorization, there is a direct appropriation of $20 million available for Fiscal 1956. Weeks said that the programming of the $20 million would be announced within "a few days." The actual programming of the $42.5 million, he said, will be postponed until November to give sponsors time to submit applications for the federal aid. This is the allocation of $42.5 million available for projects in the various states and territories. If funds available to a state are not used they are re-distributed for other projects. (For allocation of the $63 million available in future years see AW July 4, p. 83.)

Airport Aid Distribution

STATE	APPORTIONMENT	STATE	APPORTIONMENT
Alabama	$557,453	North Dakota	403,963
Arizona	626,363	Ohio	1,007,401
Arkansas	447,292	Oklahoma	560,975
California	1,822,733	Oregon	621,418
Colorado	636,846	Pennsylvania	1,268,087
Connecticut	226,837	Rhode Island	84,771
Delaware	43,320	South Carolina	361,815
Dist. of Col.	80,181	South Dakota	438,171
Florida	567,904	Tennessee	532,270
Georgia	628,279	Texas	2,062,518
Idaho	463,324	Utah	479,882
Illinois	1,147,767	Vermont	84,144
Indiana	568,492	Virginia	535,350
Iowa	533,551	Washington	578,714
Kansas	588,176	West Virginia	316,755
Kentucky	488,782	Wisconsin	662,604
Louisiana	507,066	Wyoming	503,193
Maine	257,066		
Maryland	292,809	Total State Apportionment	$30,000,000
Massachusetts	511,521	Discretionary Funds	10,000,000
Michigan	1,103,063		
Minnesota	714,790	Total Funds for Cont. U.S.	$40,000,000
Mississippi	450,702		
Missouri	731,121	**TERRITORY**	**APPORTIONMENT**
Montana	771,534	Alaska	$1,125,000
Nebraska	506,008	Hawaii	625,000
Nevada	551,366	Puerto Rico	500,000
New Hampshire	98,144	Virgin Islands	250,000
New Jersey	521,111		
New Mexico	657,128	Total For Territories	$2,500,000
New York	1,737,488		
North Carolina	659,639	Grand Total	$42,500,000

75% of authorization is apportioned for projects in each state on an area—population formula; 25% is discretionary, and may be allocated without regard to state boundaries.

Peak EAL Profits, Traffic

Eastern Air Lines reached record company highs in both earnings and traffic during the first six months of this year.

In a report last week on first-half gains, EAL Board Chairman Eddie Rickenbacker said the carrier's net profit increased to $4,174,819, equal to $1.68 a share, compared with $1,484,848, or 60 cents a share, for the same period of 1954. Traffic climbed to 3.5-million passengers flown nearly 2 billion miles.

Gross operating revenues totaled $102,680,000, 18% higher than the $86,989,000 reported for the first six months of last year. Operating expenses gained 12% to $87,267,000, compared with a 17% increase to $77,910,000 during the comparable period a year ago.

In addition to tighter cost control, Capt. Rickenbacker said the higher earnings reflected better utilization of Eastern's aircraft. While the number of seat-miles operated increased only 11% to 3,029 million, revenue passenger-miles gained 20% to slightly less than 2 billion. Load factor was 63.60%, as compared with 58.68% last year.

Rickenbacker reported that aircoach accounted for a large part of the traffic increase. Of the total passenger-miles flown, 47% were on coach schedules. Aircoach accounted for 41% in the first half of 1954.

Another New York-Miami Carrier Not Needed, Say National, Eastern

Washington, D. C.—Two highly competitive eastern seaboard carriers—National Airlines and Eastern Air Lines—found momentary accord last week in their presentations at Civil Aeronautics Board hearings of the New York-Florida Route Case.

Each carrier said that certification of another airline between New York and Washington and Miami is unnecessary, even undesirable. Both strongly urged the denial of all applications for third carrier service between New York and Miami.

The two carriers not only met on common ground in individually opposing all applicants but were in agreement as well on the disposition of Northeast Airlines, which was singled out as the leading contender in the case.

Northeast Offer

National's President George T. Baker offered to buy Northeast Airlines. This was preceded by a suggestion from William L. Morrisette, Jr., Eastern vice president, that the Board should institute an investigation aimed at the integration of National and Northeast. Morrisette said the failure of Northeast to consolidate with National was due to Atlas Corp.'s ownership of 55% of Northeast's stock. Baker declared, however, that the record shows "Atlas has no objection to accepting National's debentures in exchange for Northeast stock."

Baker said, "National makes its offer to purchase the Atlas interest in Northeast because a certificate for Northeast would vastly increase the latter's subsidy requirements plus the fact any third carrier on the route would create a situation which would result in National also requiring subsidy." National's future ability to survive against Eastern, Baker said, "will be difficult enough without the crippling blow which would result by putting a third carrier on our route."

Seeks New Service

Baker said National plans to buy six turbojets and 12 turboprop airliners plus eight more Douglas DC-7's for the use on its one line route down the east coast. He added his own $95 million expansion program to that of Eastern Air Lines and said that any competitor on the long-haul route would be facing competition from the newest and fastest equipment in the nation within two to five years.

Considerable attention was devoted by Baker to the request of National for the removal of current operating restrictions. He particularly promoted National's application to serve Providence, R. I., and Boston, Mass., asking Examiner T. L. Wrenn to recommend that CAB extend National's routes 184 miles north to Boston.

New turnaround service between Washington and New York was stressed by Baker. He said, "Certainly carriers the size of Eastern and American Airlines are not entitled to protection from a carrier the size of National, particularly when such restrictions result in undue burdens to National."

William A. Perry, assistant vice president and general sales manager of National, testified that because of CAB's restrictions on operations into and out of Washington, National must duplicate service south by operating aircraft down parallel routes. He supported Baker's testimony for turnaround service in the lucrative Washington-New York market. Perry said that by scheduling Convair 340 aircraft, "we'd certainly be competitive with American's Convair 240s and Eastern's Martin 4-0-4s."

Here are the actions urged by National:

- **Deny all applications** for third carrier service between New York and Miami.
- **Approve National's** extension from New York to Boston.
- **Remove National's** present operating restrictions.
- **Deny Eastern's** Tampa/St. Petersburg application.
- **Deny Capital's and Eastern's** Norfolk area applications.
- **Approve National's** application for service to Raleigh/Durham, N. C.
- **Renew National's** authority for service to Newport News/Hampton/Warwick, Va.

Eastern Air Lines also based its case on the necessity for denying all route applications plus the removal of three major restrictions affecting its operations. Morrisette told CAB that Eastern's applications for new services were of more importance than the question of whether there should be a "triplicating" competitive service between Florida and New York.

Restrictions Eastern proposes to have removed are:

- **The requirement** that flights from Boston, Providence, Hartford/Springfield and New Haven must originate or terminate at points south of Richmond or west of Charleston, W. Va.
- **The restriction** against non-stop flights between Tampa/St. Petersburg/Clearwater, Fla., and points northeast of Atlanta, Ga., which makes Atlanta a compulsory stop.
- **The requirement** that Miami-Tampa flights be scheduled only for origination or termination at Atlanta or Birmingham, Ala. or points north of either.

Eastern made application in the proceeding for the addition of Norfolk, Va., to its routes 5 and 6 for service north to New York and Boston via intermediate points, south to Miami and San Juan, and southwest to Texas, and via various intermediate points.

As Eastern's major policy witness in the New York-Florida hearings, Morrisette concluded on the premise that the applications to "triplicate" service between Miami and New York "are wasteful proposals which would have an adverse effect on the entire air transportation industry, upon the systems of both Eastern and National Airlines, and even upon those carriers who propose those wasteful new services."

EMPLOYMENT OPPORTUNITIES

CAB ORDERS

(July 28—Aug. 3)

GRANTED:

Flying Tiger Line an exemption to perform a roundtrip charter flight between Cleveland, Ohio, and Beirut, Lebanon, pursuant to a contract with the Junior Guild of St. Elias Church, Cleveland.

Ozark Air Lines authority to suspend service at Chanute Municipal Airport, Chanute, Kan., for 30 days from July 16, 1955 or until adequate runway repairs have been made.

APPROVED:

Agreements between North Central Airlines, Ozark Air Lines and various other carriers relating to inter-carrier arrangements.

ORDERED:

Lake Central Airlines to show cause why a temporary rate of 86.1 cents should not be set for the period starting May 2, 1955.

American Airlines permitted to suspend service at Elmira-Corning, N. Y., for a two year period.

El Al Israel Airlines re-issued a foreign air carrier permit reflecting a change of name from "El Al" Israel Airlines.

Mohawk Airlines' temporary mail rate set at the rate proposed by the CAB in its show cause order for the period starting July 1, 1955.

Suspension and investigation of a reduced fare filed by Airline Transport Carriers, Inc. between San Diego and San Francisco.

Airways Parcel Post Service, Inc., and Air Lanes Service, Inc. letters of registration suspended unless the companies file certain overdue reports by Aug. 12, 1955.

West Coast Airlines to show cause why its temporary mail rate should not be set at $1,607,209 for the period Nov. 1, 1953, to Oct. 31, 1954, and 52.53 cents for the period starting Nov. 1, 1954.

DISMISSED:

Transocean Air Lines' application for a charter exemption, at Taloa's request.

DENIED:

Transportes Aereos Nacionales' petition for revocation of Pan American World Airways' authority to operate nonstop flights between Havana, Cuba, and Tegucigalpa, Honduras.

Alaska Airlines and **Pacific Northern Airlines'** petitions for reconsideration in the States-Alaska case.

Colonial Employes Mutual Fund, Inc. leave to intervene in the Colonial-Eastern acquisition case.

CAB North American Decision is Praised

The Civil Aeronautics Board decision banning service by North American Airlines was applauded in a speech before Congress by Rep. Walter Riehlman (R.-N. Y.). He also inserted in the Congressional Record AVIATION WEEK's editorial, "The North American Case: A Mockery." Riehlman said:

"The charges against this carrier are most serious. They are all based on the basic issue of repeated wilful violation of the laws of the United States. These are not minor violations. They constitute the first and only instance . . . of such long continued operation of a full-blown scheduled airline without the award of a certificate . . ."

BEA Starts Copter Shuttle Service

British European Airways' Westland-built S-55 helicopter lets down for a landing at the end of its flight inaugurating scheduled passenger shuttle service between London Airport and Waterloo Air Terminal. The copter is operating on eight roundtrips daily. The S-55 has dual floats and wheels—an amphibious configuration that has aroused U. S. interest.

SHORTLINES

► **Braniff Airways** carried 830,746 passengers in the first six months of this year, an 18% increase over the same period of 1954. The carrier flew 336,682,000 passenger-miles with a load factor of 60.23%.

► **British European Airways** reports it became the first airline outside the United States to carry 2-million passengers in a year on July 27, 1955.

► **Hawaiian Airlines and Trans-Pacific Airlines** have been awarded contracts totaling $95,000 to carry Army personnel among the Hawaiian Islands during maneuvers of the 25th Division.

► **North Central Airlines** carried 46,408 passengers in July 52% more than were carried in July, 1954.

► **Pan American World Airways** will extend its fly now-pay later plan to Panama Sept. 1.

► **Sabena Belgian World Airlines,** is offering a la carte dining service to first-class trans-Atlantic passengers. A choice of three main courses is now available in place of the usual standard meal.

► **Trans World Airlines** flew 359,500,000 passenger-miles in July, an increase of 11% over the previous July.

► **United Air Lines** reports passenger traffic of 389,465,000 passenger-miles in July a 20% increase over July, 1954. Freight traffic was up 28%, express 23% and mail 13%.

► **American Airlines** claims a world traffic record of 416 million passenger-miles in June, a rise of 13.2% over the previous June. American carried 686,000 passengers, up 12.4% over June 1954.

► **KLM Royal Dutch Airlines** started a credit travel plan for United Kingdom residents July 1. The plan requires 10% down payments and allows six or twenty months for payment.

► **Calcutta's Dum Dum Airport** is getting Decca approach control radar for use as an approach aid and to supplementing range storm warning radar that is already in use at the Indian airfield.

► **Executive Flight Service, Inc.,** has been licensed by the Canadian Air Transport Board for international non-scheduled charter service to all parts of Canada with aircraft having a payload under 6,000 lb.

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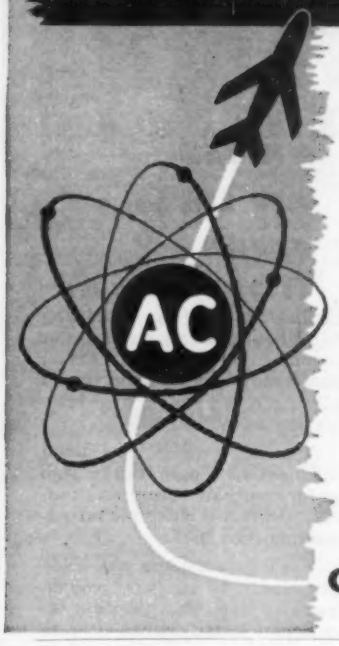

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P-7306, Aviation Week
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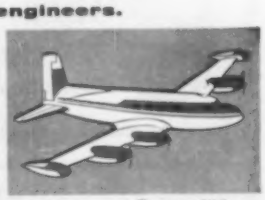

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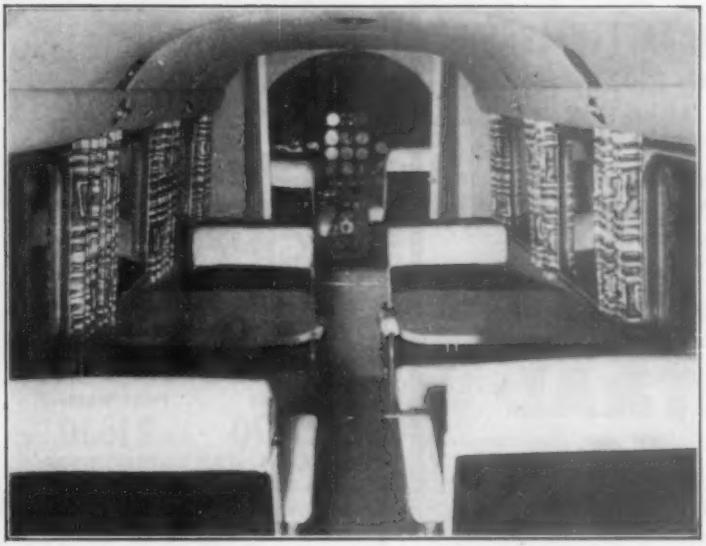

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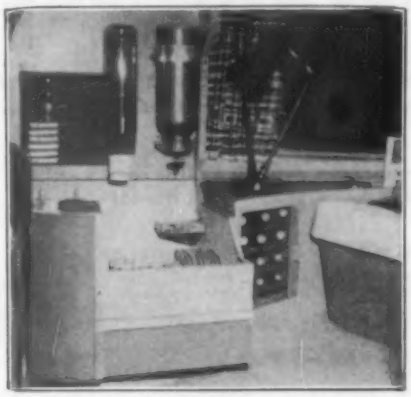

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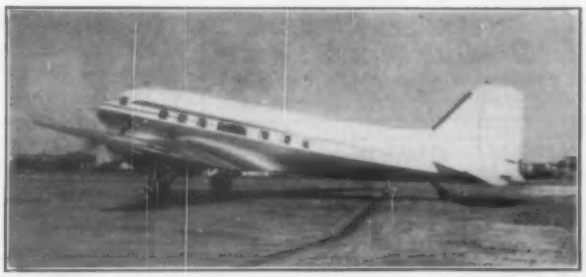

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EDITORIAL

Air Power Shadow Over Geneva

(Gen. Nathan F. Twining, USAF Chief of Staff, presented the first appraisal of the future role of nuclear-armed air power as a result of the Geneva conference in his keynote speech last week at the Air Force Assn. convention in San Francisco. Because of the importance of this key policy speech Aviation Week is presenting significant extracts.—Robert Hotz)

"No one has claimed that the Geneva meeting resulted in specific agreements on concrete questions.

"For years we have said that air power is peace power. This truth has been demonstrated, and no one can deny that the shadow of air power fell across the conference table at Geneva.

"We of the Air Force are proud that American air power was prominent in that strength needed to negotiate on these great matters.

"We are even prouder that our President took the lead in proposals aimed to reduce the paramount fear of our times—the fear of surprise air attack and the great devastation of air warfare.

"The world welcomed the President's proposal to the Soviet Union to exchange facilities for aerial photography. This plan was aimed squarely against surprise attack. I sincerely believe this could be a key step toward peace.

"The President's outline for preventing surprise attack carried with it a sincerity and significance that made a profound impact. His actions should be reassurance to all that he and this nation are champions of peace.

"If this proposal is accepted, the Air Force will enthusiastically devote its energies to make this great idea work.

"Even the Air Force bases where we are now standing 24 hours vigil against a possible Soviet attack would conceivably be made available to the Soviets for this purpose.

"While we seek better ways to safeguard peace, we are determined to maintain our strength until mutually dependable systems for reducing armaments have been worked out.

"For, while Geneva commanded attention in mid-July, the eyes of the world were drawn to Moscow in May when the Soviet Union paraded its military might for all to see.

"As they readied their air might to celebrate May Day, the rulers of the Soviet Union made a different but no less lasting impression on us. They showed all the world that they too had learned the air power lesson all too well. The intercontinental jet bombers, the medium jet bombers, and the supersonic fighters flying over Red Square were grim evidence of what many of us had already realized—that Soviet Russia had become a modern, powerful arsenal of air power.

"Just last week—only days after Geneva, the Soviets resumed testing of nuclear weapons. It is clear that Geneva must be weighed against Moscow. It is also clear that although air power has been the motivating force behind the quest for peace, it is a force we must keep if we are to have peace.

"If we should allow ourselves to become relatively weak in the air, our efforts to achieve a workable peace would no doubt fail.

"In the meantime, while we weigh the hopes of Geneva let us also remember Moscow in May. Let us be sure that we more than match Communist air power. We know from bitter experience that Communist smiles can change to scowls and velvet can turn to steel. A very wise man once uttered this word of caution, 'You don't take your coat off everytime the sun shines in Moscow.'

"Last year when I discussed the Soviet air strength, and the knowledge we had of it at that time, I said that the Air Force we are building was planned on the basis of present rather than future Soviet strength. I warned that if the Soviet air force continued to improve, we would have to step up our own efforts.

"In measuring our air power against the Soviets, there is one thing I would say here today: We are still ahead, well ahead, in the kind of air power the Soviets respect.

"However, in view of the technological and production achievements of the Soviets, we have decided to speed up our timetable in both offensive and defensive forces.

"The aviation industry has responded magnificently to this challenge.

"Now I want to mention something else new that we are trying to add to the Air Force—that is stability.

"Do you realize that in a period of about six years, the planned size of the Air Force has changed eight times? It has gone from 66 wings to 55, then 48, then 42, 95, 143, 120 and finally 137 wings. It is significant that for the past two years we have been set on the latest goal—137 wings. This has meant two years of comparative stability.

"It might be obvious to say that it's hard to make progress if your goals keep changing, but I am afraid that has been the situation in the Air Force for several years. In the period of fluctuating force levels and bouncing budgets, it is a wonder that the Air Force did as well as it did.

"However, stability doesn't mean inflexibility. We all know that a 137-wing Air Force is not a permanent solution to our air power needs.

"In one way this stability could make the coming years a period of great danger. The apparent easing of international tension could lull the nation into dangerous complacency. The progress we have made in building our strength up to its present strength of 124 wings could be relaxing.

"The progress we have made must not be confused with the future strength we need. We still have a long way to go.

"It is up to us in the Air Force and to the supporters of the Air Force to keep interest in these goals.

"If we lose the battle for peace, it will not be because United States air power failed, but because the United States failed its air power."

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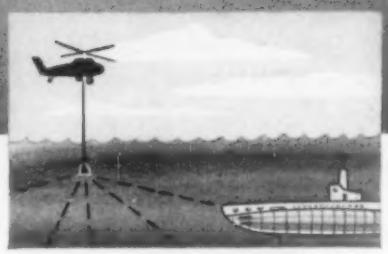

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